#17

A Patient Classification System for Long-Term Care

Brant E. Fries, Ph.D.
Rensselaer Polytechnic Institute
Troy, New York

Leo M. Cooney, Jr., M.D.
Yale University School of Medicine
New Haven, Connecticut

April, 1983

A Patient Classification System for Long-Term Care

Brant E. Fries, Ph.D.
Rensselaer Polytechnic Institute
Troy, New York

Leo M. Cooney, Jr., M.D.
Yale University School of Medicine
New Haven, Connecticut

April, 1983

The research described in this paper was supported in part by grant #18-P-97757/1-01 from the Health Care Financing Administration

A Patient Classification System for Long-Term Care
Executive Summary

Brant E. Fries, Ph.D.
Rensselaer Polytechnic Institute
Troy, New York

Leo M. Cooney, M.D.
Yale-New Haven Hospital
New Haven, Connecticut

This study was designed to produce a method of classifying long-term care patients into a manageable number of groups which were relatively homogeneous in their care needs. The groups, denoted Resource Utilization Groups (or "RUGs") could then be used to determine the relative care provided to patients in long-term care institutions in order to develop a case-mix profile of the intensity of patient care in each institution.

The study consisted of two separate analyses, each utilizing a clustering methodology originally employed in the development of the acute-care hospital Diagnosis-Related Groups (DRGs). The first analysis used nursing home staff's subjective estimates of care requirements as the dependent variable surrogate for long-term care (LTC) needs. The second analysis used measured aide time as this dependent variable. The derivation of commensurate classifications from more than one data set demonstrates the stability of the results obtained.

The first analysis involved data collected in a study performed by Yale and Connecticut Area Professional Standards Review Organization (PSRO) II. Over fourteen thousand patient assessments were performed during PSRO II utilization and quality review on over eight thousand patients in 76 Connecticut skilled nursing facilities during a fifteen month period. PSRO reviewers also recorded subjective estimates of the care needs of 1,469 of these patients from their facility's nurses and aides. In a substudy, the actual time required to care for 426 of these 1,469 patients was directly observed and recorded. Good correlation was found between these observed times and the subjective measures. The combination of nurse and aide classification of the intensity of care required for each patient, rated from 1 (minimal care) to 5 (maximal care) was selected to describe the resource use of the PSRO long-term care patients. The percentage of patients in each classification was rather even, with a mean classification of 3.22 and with no skew towards maximal care. This "average classification" was used as the dependent variable in the development of the first patient classification system.

The PSRO II patient assessment reviews provided 96 variables describing the demographic, social, physical, mental, functional, and medical characteristics of these skilled nursing facility patients. A clustering algorithm was employed to determine the ability of these patient descriptors (the independent variables) to "explain" the variation in the dependent variable -- the average classification of intensity of care.

Nine variables individually produced more than 20% reduction in variance. These nine were independence in toileting, dressing, personal hygiene and feeding, ability to ambulate, transfer from bed to chair, continence of bladder, continence of bowel and combined continence of bladder and bowel.

Using AUTOGRP, an implementation of Automatic Interactions Detection, the patient population was partitioned into subgroups by several splits, each split based on the values of the particular independent variable and chosen so as to maximize the explained variation in the dependent variable. Patient variables were selected which produced the best reduction of the variance, while being clinically meaningful. The characteristics chosen were the ability to dress, ambulate, and feed oneself, and whether intake and output was recorded.

This grouping technique divided the population of 1,469 long-term care patients into nine groups, denoted the PSRO Resource Utilization Groups. The mean classification for these groups ranged from 2.1 in the least intensive RUG to to 4.5 in the most resource-intense group.

A similar analysis was then performed on two data sets assembled by the Battelle Institute in 1974 and 1977. Both of these studies directly measured long-term care facility nursing and aide time. These times were compared with patient-related data including measures of the physical, functional, mental and social capabilities of patients, their diagnoses, the number and types of medications used, and so forth. The 1974 study involved 1,615 individual in 12 long-term care facilities "delivering quality services efficiently." The 1977 study included 16 facilities chosen to be representative of the diversity of quality seen, with a total of 1,231 patients.

The AUTOGRP analysis using observed aide time as the dependent variable was applied to the 1,615 patients in the Battelle 1974 study. The patient-related variables measuring ability to transfer, to dress, and to feed were used in the construction of seven Resource Utilization Groups. The mean aide time in the least intense group was 25 minutes and in the most intense group 104 minutes, compared with an overall mean of 52 minutes for all 1,615 patients.

The analysis of the Battelle 1977 data again revealed that independence in bathing, dressing, feeding, toileting, and ability to transfer, as well as the use of restraints, produced high variance reduction in aide time. The analysis produced 8 Resource Utilization Groups and demonstrated a range in aide time from 28.5 minutes to 194 minutes.

All three analyses found that Activity of Daily Living characteristics (ability to dress, feed, toilet and bathe oneself), ability to ambulate and transfer, and continence of bladder and bowel were the best predictors of patient care needs as measured either by staff subjective estimates or by actual measured aide time. These results confirm the work of earlier investigators. The results also validate the use of staff subjective estimates as a surrogate for patient care needs, as these estimates gave almost identical results as analyses based on the time-and-motion studies.

The RUGs were based on only a small number of patient characteristics. The incidences across the RUGs of other descriptors felt to be important in LTC patient care needs — incontinence, ability to toilet, ability to transfer, and confusion — were determined. The percentage of patients with these characteristics increases almost linearly from the least intense to the most intense care groups. This "tracking" demonstrates that these few patient class indentifiers are appropriate surrogates for other care-related patient characteristics, and that they are "captured" in the RUGs. On the other hand, diagnostic information, either as individual diagnostic codes or as groups of diagnoses, provided no explanatory power of resource utilization.

Three separate grouping systems were produced from the three analyses described above. Similar characteristics were used in all three RUG systems (dress and feed in all three, transfer in two, and ambulate, intake/output, and use of restraints in one each). The three systems, when applied to a sample of 8871 federally-funded patients in 76 facilities, performed similarly, i.e., patients were assigned to similar groups using all three systems. This similarity again confirms the validity of the subjectively determined dependent variable used in the creation of the PSRO Resource Utilization Groups, as well as demonstrates the applicability of the RUGs outside of Connecticut.

The RUGs permitted an analysis of the relative care needs of LTC patients and produced a case-mix index for LTC institutions. When computed for 63 skilled nursing homes in the PSRO sample, significant variation was seen across facilities in the average care needs of their patient populations. Initial analysis of the operating costs of these skilled nursing facilities employing this case-mix measure was also performed.

Table of Contents

Acknowledgements

Any project like this is only possible with the help of many people. We were especially lucky to have an excellent set of colleagues who formed the core staff. Foremost of these was Jeannette Ryan who undauntingly pursued all the branches and splits of AUTOGRP for almost a full year. Chris Goff provided valuable computer expertise and Scott Stratton the cost analysis. Debra Miser arranged and executed the facility observations and Jean Freeman lent her expertise when it was needed to perform the Klastorin analysis.

We also owe a significant debt to John Thompson and Robert Fetter; without their pioneering effort in DRGs and their strong support of this effort, it never would have come to fruition. In the earlier stages of this project we were also grateful for the conceptual work performed by Terry Wetle and Richard Averill.

But this is only one side of the story. The most important help we could count on was from those outside of Yale. We thank Korbin Liu, our HCFA Project Officer for his continued patience during the project and after, waiting for this final report, and to Betty Cornelius also of HCFA for her unflagging support of all long-term care research. Five nursing homes generously opened their doors to us and made the project possible. These were the New Haven Convalescent Center, Jewish Home for the Aged of New Haven, Golden Hills Nursing Home, Meridan Nursing Home, and Cove Manor Nursing Home. Also we are indebted to the staff of PSRO II, to Cheryl Quigley, Mary Skelley, Dorothy Gordon, and all the nurse review coordinators, in particular, for their help and patience with our research effort. Finally, we wish to thank Kenneth McCaffree and Suresh Malhotra of the Battelle Institute for making the results and raw data from their work available to us.

Finally, the people that make any project go: Anne Palmeri who kept all the accounts, and Marla DeMusis and Anne Scaramella who typed enumerable pages without a whimper.

A Patient Classification System for Long-Term Care
Final Report

1. Introduction

The demand for services for the elderly requiring long-term care is expanding rapidly and the resources required to fill these needs are consuming a larger and larger proportion of American health care expenditures.[1] Nursing home expenditures now comprise the fastest rising component of personal health care expenditures, and have risen over the past several years at a rate which is more than double that of the consumer price index. Public expenditures now represent 57% of the national nursing home costs and over 12% of public spending on all personal health care. Nursing home care absorbs more than one third of all Medicaid expenditures.[2]

This escalating problem makes it essential that methods be developed which ensure that long-term care resources, which will become increasingly scarce, be properly matched with those most in need. Scanlon has identified four major concerns in the field of long-term care:

> ... to stem the rising cost of nursing home care, reduce or eliminate unnecessary utilization, achieve appropriate placement, and provide for unmet health, social, and basic needs of the elderly residing in the community."(pg. 15)[3]

The lack of a measure of need, or at least of those resources utilized by long-term care (LTC) patients can be seen to be intimately involved with the problems Scanlon presents:

a. it is impossible to derive the costs of caring for patients without understanding the needs of those same patients. Basing estimates on historic costs only reinforce the current status quo, and have been suggested to be a major determinant of the increasing cost of long-term care

b. reimbursement made to a facility for an individual patient is not appropriate to the care that patients requires; in fact, the reimbursing and licensing systems currently in use in most states make little allowance for varying care needs of patients inside a specific institution. Whether reimbursement is flat rate or facility-cost related, each patient within the same level in the same facility usually is reimbursed at the same rate. With a variety of patients with differing care needs it would be solely by chance that the reimbursement would be commensurate with the cost of the resources required by the set of patients currently under its care. Either too much reimbursement, leading to unnecessary system cost and possibly inappropriate profit for the facility, or too little reimbursement, with probable reduction in the quality of care, is detrimental. Willemain has addressed the issue of paying for the "right" amount of services received by each nursing home resident. He pointed out that:

> too high a level of reimbursement would generate excessive profits, induce undesirable entries into the industry, and possibly provide an incentive to provide an excessive length of stay. Too low a level of reimbursement would provide a disincentive to adequate care, and may ultimately reduce entry and create a shortage of capacity.[4]

Similarly, Vladeck states in Unloving Care:

> Tying the rate a facility receives to its costs for providing service should insure that most of its revenues are being devoted to patient care.(pg. 45)[5]

The difficulty in setting reimbursement rates is the determination of cost. A variety of studies have attempted to explain the factors affecting cost, focusing on institutional variables such as type of ownership, nature of care given, number of beds, occupancy, and location. Eleven such studies have been reviewed by Birnbaum[6] However, these approaches appear to focus on only part of the problem: they examine institutional factors when in fact it is the care needs of individual patients that is a major determinant of cost.

c. with no incentives, either through reimbursement or otherwise, for a facility to admit particular patients, facilities will "cream," i.e., try to select from those patients eligible the ones with the least care needs. This causes problems of access to care for certain patients, particularly those "heavy care" Medicaid patients who are in acute hospitals awaiting placement.

d. similarly, there is no incentive for a facility to return a patient to home or a less care-intensive facility when they are ready. Patients are inappropriately placed, often increasing the cost to the system.

A variety of applications can be suggested for a measure of resource consumption. The one most often proposed is for reimbursement, but others may eventually be more important. These might include the use of such a measure for comparison of long-term care facilities, for their internal management (including staffing), for the evaluation of care plans, and as part of the determination of quality of care. Without a measure to adjust the cost or performance of a facility for the patients it cares for, it appears fruitless to attempt to understand what efficiencies or inefficiencies can be attributed to the production of services, cost, quality of care, or to such a case-mix.

Long-term care patients vary greatly in their needs and in their nursing and personal care requirements. There is little uniformity among experts, however, on how much care is required for which kinds of patient care problems. While one recognizes that it is clearly difficult to assign an absolute care need to each patient, we are not even able at present to determine the relative care needs of long-term care patients. In order to have resources to provide for unmet needs, and in order to control costs, improve utilization, and achieve proper placement, we must develop appropriate systems to quantify the long-term care needs of the elderly patient.

The current Federal approach to classifying the care needs of patients is to identify them by the type of facility in which they reside: either a Skilled Nursing Facility or an Intermediate Care Facility. The Federal Skilled Nursing Facility (SNF) is direct descendent of the Medicare Extended Care Facility, and is designed to provide skilled care and restorative care for those patients recently discharged from acute care hospitals before returning home.[7] The majority of SNF beds, however, are filled with patients with predominantly personal care needs who will never return home.[8] Intermediate care facilities (ICFs) are designed for those patients primarily requiring personal care involving less skilled nursing or rehabilitation. As there is no reason to suspect that care needs of nursing home patients vary greatly from state to state, the tremendous discrepancy between the ratio of Skilled Nursing Facility to Intermediate Care Facility beds in the U.S. (from 92:8 in Florida, to 3:97 in Iowa)[9] demonstrate the inability of this "level of care" system to properly match resources with patient care needs.

A variety of other systems are currently in use to evaluate the resource consumption of patients with the goal of developing more appropriate reimbursement systems. Several states have attempted to reflect patient care needs more accurately by creating several levels of care within the Skilled Nursing Facility and Intermediate Care Facility categories (New York, Massachusetts, and to the greatest extent, Wisconsin). Multiple levels of care can be administratively awkward and expensive, however, and the costs, adequacy, and frequency of utilization review also creates problems. Other states (Illinois, West Virginia, and Ohio) have adopted individual patient assessment systems. Illinois incorporated a point-count system based on the sum of each patient's debility and dependency characteristics, into its reimbursement system.[10] West Virginia has established a LTC reimbursement system which separates the costs of each nursing home into three components: investment, operating, and nursing costs. Nursing costs are reimbursed based on a schedule which weights the need of patients for particular services by the time needed to perform this service and a wage factor for the skill level of nursing required.[11] These systems, while addressing varying patient needs, require frequent assessments (SNF patients in Illinois are evaluated every 60 days) and have little hard data to tie their point-scores to the actual (or relative) costs of caring for the dependency needs of each patient.

In order to evaluate, cost, compare, and provide relevant feedback regarding the performance of individual long-term care facilities, it is necessary to identify the specific "products" which these institutions produce. The product of a LTC facility is the set of services provided to a patient and the resources used as part of the caring process. While each individual patient admitted to an institution is unique, he or she has certain mental, physical, and medical characteristics in common with other patients that determine the amount and level of services received. If classes of patients with the same characteristics and similar processes of care can be identified, then the framework within which to aggregate patients into case types is established. Moreover, if these classes cover the entire range of patients in LTC institutions, then collectively they constitute a classification system that provides a means for examining the products of the LTC system. Such a classification system would provide the structure for a case-mix measure.

The major goal of this study was to define a measure of case-mix for long-term care. The methodology employed consisted of the construction and application of a classification scheme comprised of subgroups of patients possessing similar attributes and utilization patterns. This involves relating the mental, physical, and medical characteristics of patients to the resources they are provided, so that classes are differentiated by only those variables related to the condition of the patient (e.g., age, functional capabilities) that affect their utilization of services. In this process we also determined the relative importance of these various patient characteristics in predicting the cost of care, and determined assessment techniques that were able to efficiently and concisely quantify these characteristics.

This report describes the results of an 18-month study undertaken by a research group at Yale University to derive such a LTC patient classification system. The following chapters review previous relevant studies, present the methodology and results of this study, and provide suggestions for their application.

2. Background

The current study relies on the results of other research in three areas: patient classification systems in the acute and ambulatory care sectors, patient assessment in long-term care, and patient classification systems in long-term care. We consider these each in turn.

2.1 Patient Classification Systems in the Acute and Ambulatory Care Sectors

There are a large number of patient classification systems either proposed or in current use, although the purposes for which they have been developed vary widely: staffing, reimbursement, quality of care audit, disease progress, and diagnosis or treatment selection, among others. We focus here on those classification systems in use for the measurement of resource consumption, commonly called "case-mix" classification systems, and most standardly employed for reimbursement, facility comparison, and internal facility management. The major systems include:

a. International Classification of Disease (ICDA) codes, using from three to four digits of the full coding of diagnoses to classify patients

b. Professional Activity Study (PAS) clusters of diagnoses which are subdivided by age and the presence of secondary diagnosis or surgical procedure.[12]

c. Diagnosis-Related Groups (DRGs), differentiated by major diagnostic groups as well as variables describing the presence of secondary diagnosis and surgical procedures, complicating comorbidities, and age.[13]

d. Disease Staging, differentiating within each diagnosis the differing complexities of the disease over time[14]

e. Severity of illness, for example based on age, body systems involved, stage of the disease, complications, and response to therapy.[15]

The arguments about the comparative benefits of each of these approaches currently rage in the literature[16] and will not be joined here, especially as many of the issues are not germaine to the current research.

The conceptual framework of this research project derives from the work performed at Yale University to develop Diagnosis-Related Groups (DRGs) Through a classification technology[17,18] a total of 383 mutually exclusive and exhaustive patient classes were evolved. Recently, these classes were reexamined and revised, resulting in 467 DRGs. There are three basic properties of the DRG patient classification scheme: 1) there are a manageable number of patient classes; 2) each DRG is medically meaningful, i.e., there is an underlying patient care process which, in the main, follows the accepted practices of a specific field of medicine; and 3) the DRGs demonstrate a statistically stable distribution of resource use within the universe of patients treated by a hospital. In the development of DRGs, length of stay initially was used as the measure of resource use. Originally used for facility comparison and utilization review, the DRGs are currently being

applied extensively in the area of hospital reimbursement (both New Jersey and New York have reimbursement systems tied to DRGs), and are beginning to be used for internal hospital management, e.g., case-mix budgetting[19,20]

In the ambulatory care setting, Fetter et al. have developed a patient classification system using physician time as the measure of resource consumption to be explained. A total of 154 Ambulatory Visit Groups (AVGs) were derived based mainly on presenting problem and prior history for the same problem (e.g., return visit for the same problem).[21]

The successes in developing comprehensive patient classification schemes in both the acute care and ambulatory areas provided the experience necessary to develop a patient classification scheme for long-term care patients. Further, the extensive applications of DRGs in the acute care setting demonstrate the central role case-mix can play in understanding the managing the health care system.

2.2 Patient Assessment Instruments

Any classification system in long-term care must acknowledge and utilize the considerable work done over the past 20 years in the definition of patient characteristics and the testing and use of patient assessment instruments. We focus here especially on those which attempt to assess the care needs of elderly patients.

The foremost of these is the great contribution by Katz in 1963 with his "Activities of Daily Living Index."[22] This is a graded index of functional activities, consisting of independence in feeding, continence, transfer, toileting bathing, and dressing. Katz listed the abilities in this order as they represent the stages of return of function after a disabling event. This scale has been used in many studies in the past 20 years, and has been helpful in predicting progress in rehabilitation following a disabling event (e.g., stroke, hip fracture amputation).[23] In addition, the activities of daily living (ADL) categories form a major part of virtually all Long-Term Care assessment instruments used today. The ADL categories appear to correlate well with nursing needs in various studies, but neither the relative impact on care needs of each of these characteristics nor the marginal impact of each has been determined.

A number of other functional indices have been developed, in which experts have assigned weights corresponding to a patient's ability to perform such tasks as drinking from a cup, walking up stairs unassisted, etc. These indicies, which include the Barthel Index, the Kenney Self-Help Index, and the Rapid Disability Rating Scale, have been helpful in predicting placement after rehabilitation,[24] but have not been used to establish care needs.

Multidimensional assessments have been developed in the past several years, with a variety of purposes. These instruments have been useful in "channeling" projects, designed to provide specific home resources to avoid nursing home placement, to establish nursing home care plans, to assess level of care decisions, and to determine the appropriateness of nursing home staffing patterns. These assessment instruments all include aspects of social intervention, mental status, behavioral problems, medical problems, and

functional "activities of daily living" levels. Examples of such instruments include the Sickness Impact Profile, the Duke Older Americans Resources and Services (OARS) Instrument, the Comprehensive Assessment and Referral Instrument (CARE) and the Patient Assessment and Care Evaluator (PACE).[25]

This work and the development and testing of these instruments has greatly benefited long-term care research. Workers can now adapt these instruments, which have been carefully evaluated for inter-observer variability, applicability, efficiency of data collection, and ease and rapidity of administration. These instruments all were carefully studied and used in this study in the selection of patient characteristics to be considered for a classification system.

2.3 Patient Classification Systems in Long-Term Care

Several systems have been proposed for classifying long-term care patients, again for a variety of purposes. Most attempted to define the dependence of the patient, but did not directly connect these dependencies to resource consumption.

Skinner and Yett developed and applied a debility index in an analysis of the 1969 Resident Places Survey conducted by the National Center for Health Statistics. The authors constructed a scale of debility including feeding, continence, ambulation, transfer/dressing, and bathing. The application of this index indicates that a patient's level of dependency is significantly related to his length of stay, total monthly charges for care, and age.[26]

Parker in 1971 constructed a "Geriatric Index" in an analysis of 1,245 Medicaid patients in Maryland. This study related 19 geriatric indicators to health care need status as defined as placement in a private home, personal care home, skilled nursing home, or chronic disease hospital. This study found that the key indicators of placement, in decreasing rank, were mobility, continence, major assistance in dressing and bathing, any special disability, severe confusion, and special treatments needed.[27]

A similar result was obtained by Swearingen, who collected profile and review data on 875 patients in facilities in several States. Patients were grouped on 3 variables: functional status, mental status, and risk factors; patients' functional status was found to be the best predictor of level of care.[28]

These three studies used either level of dependency or placement as the dependent variable to be explained. For purposes of resource allocation or reimbursement, a measure must be better linked to actual resource consumption. Two groups have done this.

As a part of a study of skilled nursing care patients, intermediate care patients, and home care patients, Flagle, et al. did careful time and motion studies of the nursing and personal care required by 192 patients. After assessing the patient using the Collaborative Patient Assessment Instrument, several subsets of patient characteristic variables were tested for their ability to predict nursing care needs. The subset which predicted care needs best consisted of the following variables: mobility, walking, stair climbing,

bathing, dressing, eating/feeding, toileting, bowel function, bladder function, orientation, communication, and mental status.[29]

Two studies were performed by McCaffree et al. at the Battelle Human Affairs Research Center to "test the feasibility and desirability of collecting self-reported information on the costs of nursing home care and to develop a system by which to adjust these costs for differences in the characteristics and conditions of resident/patients in different facilities."[30]

The 1974 Battelle study[31] collected the conditions and characteristics of 1,615 nursing home residents/patients in 5 States, residing in 12 facilities. Contact time of the facility's staff with patients was monitored over a 48 hour period. The fraction of total variance in employee time explained by each patient characteristic and condition was evaluated using the Automatic Interactions Detector (AID). Those characteristics which explained significant amounts of variance in employee time were selected for further evaluation.

Multiple regression equations were performed where direct contact time was regressed on patient characteristics defined as one or zero, depending on the presence or absence of the given characteristic. Based on the strength of the coefficient and the amount of variation explained in different equations, the regression coefficients from these equations were weighted to obtain a relative time weight associated with each of the particular characteristics and conditions. The characteristics which produced high relative weights for licensed nurses and aide contact time included bathing, dressing, transfers, incontinence, and feeding, and the requirement for more than ten medications.

The 1977 Battelle examined a total 1261 patients of 16 nursing homes in three states.[32] Homes were stratified by size, ownership/control, location and staffing level, both to improve the representativeness of the data base as well as to permit the testing of the effect of these variables. Again, the most influential variables were identified by AID and regression analysis used to determine relative weights of these most important variables. The study showed that the 1974 results were generally reproduced for the 1977 data, and that there was "no firm basis on the evidence to justify revision." Also, they found no significant effects of the variables describing homes used to stratify their sample.

A number of studies have thus addressed the issue of long-term care patient characteristics and the amount of care associated with these characteristics. The studies comparing patient characteristics to staff time (Flagle and Battelle) have been limited in their patient numbers (Flagle) and reported in a manner which is not easily adapted to a "case-mix" profile of facilities (Battelle).

The present study was to develop groups of patients, defined by patient characteristics, which have a similar value of resource consumption (here staff time -- nursing and aide -- required to care for these patients). These groups could then be used to develop case-mix profiles of long-term care facilities and thereby permit their comparision.

3. Methodology

The overall concept of this project parallels the work done at Yale to develop a patient classification scheme in the acute health-care sector. Diagnosis Related Groups (DRGs), the product of this research, has provided a useful tool with which to measure case-mix. Basically, a dependent variable, linked to resource consumption, is chosen. Then, clusters of patients are developed, the clusters differentiated by patient characteristics, which have similar values of the dependent variable. The clustering is accomplished using AUTOGRP, an interactive statistical language to provide Automatic Interaction Detector (AID).[33] The set of final clusters represent a measure of the "product" of the systems, and thus the structure for evaluating case-mix. In forming DRGs, the dependent variable employed was length of stay, and a variety of independent variables, including diagnosis, complications, and surgical procedures, were used to form the clusters.

3.1 Applicability of DRG Methodology in LTC

Several major problems specific to LTC make the application of this methodology more difficult. These include lack of a clearly defined and readily available dependent variable; lack of large, uniform data sets describing patients in LTC facilities; and complications in determining a structure for patient classifications. We elaborate further on these here.

a) Lack of Dependent Variable

As mentioned earlier, the development of Diagnosis Related Groups was performed using length of stay (LOS) as the dependent variable. This variable has the advantages of being reasonably reliable, well defined, and readily available in standard data sets such as the Uniform Hospital Discharge Data Set.[34] Recent work by Fetter et al.[35] has shown that the DRGs based on LOS are concordant with those based on other measures of resource consumption, and in particular on cost.

In LTC, unfortunately, one cannot identify as easily a dependent variable representing resource consumption. Certainly, LOS has little meaning in this setting. Direct measures of resource consumption in LTC, such as staff time, are not easily available and there is considerable complexity in allocating such time accurately and reliably to individual patients.

We chose here to use staff time as the measure descriptive of all LTC resource consumption. Staff time, by itself, accounts for 37.9% of all nursing home costs in Connecticut[36] and probably a much greater percentage of the variability of these costs, as allocated to individual patients.

It is a difficult and expensive task to determine the amount of staff time required by a large number of long-term care patients. We elected to obtain subjective estimates given by nursing home staff of the time required for each patient they treated. We then determined which of several techniques of staff estimation was most accurate by measuring direct staff time on approximately one third of the patients on whom subjective estimates were obtained. Although we are the first to use such a methodology in LTC, it has been used successfully by others in acute care hospitals to estimate nursing time.

b) Lack of Standard Data Set of Patient Characteristics (Independent Variables)

Research in the hospital acute care sector has been aided by the availability of the Uniform Hospital Discharge Data Set, among others, which includes a variety of data elements useful in distinguishing groups of patients. A number of long-term care assessment instruments have been developed over the past decade, and the elements of these instruments are becoming more and more uniform. The Long-Term Care Minimum Data Set published in 1980 by the U.S. Department of Health and Human Services[37] contains the essential components of all of these assessment instruments. In a later section we discuss the data instrument used in this project, one based on the major preceding instruments and containing all the components of the LTC Minimum Data Set.

c) Lack of Organization Structure for Patient Groups in LTC

One of the advantages of the interactive statistical analysis package (AUTOGRP) used in this project is that human intuition can be blended with statistical inference in determining the homogeneous patient groups representing case-mix. Thus, rather than following explicitly the optimal partitions recommended by the statistics of the computer, the analyst can overlay an intuitively-based structure which makes the clusters more meaningful.

In the acute-care setting, major classes of diagnoses, as represented in the International Classification of Diseases, provided such an initial structure. Previous studies have indicated that diagnosis is at best weakly predictive of resource consumption.[38] These studies have all also indicated that a patient's ability to perform normal daily activities such as bathing, feeding, toileting, dressing, and walking is key to his long-term care needs.[39-41] Other measures such as incontinence, confusion, and sociability have been suggested as characteristics which predict care problems or placement. Our analysis was able to examine the relative importance of all these characteristics in the time required to care for these patients. Nevertheless, in LTC it is more difficult, *apriori*, to discern the appropriate structure for patient groups.

3.2 Overview of Methodology

The analysis performed in this study is represented in Exhibit 3-1. The LTC patient classifications were derived from three sources. The first classification system was based on independent variables describing patient characteristics collected by Connecticut Area II Professional Standards Review Organization, and, as the dependent variable, subjective estimations made by Skilled Nursing Facility staff of the relative care required by these patients. These subjective estimations were validated by a study performed in five nursing homes to obtain objective measures of staff time. Together these produced the Resource Utilization Groups (RUGs) that are the major result of this study. Two other classification systems were obtained employing data from the 1974 and 1977 Battelle Institute studies,[42,43] using aide time as the dependent variable. These three classification systems were then examined for compatibility, to see whether, despite differences in structure, they represented different classifications of individual patients.

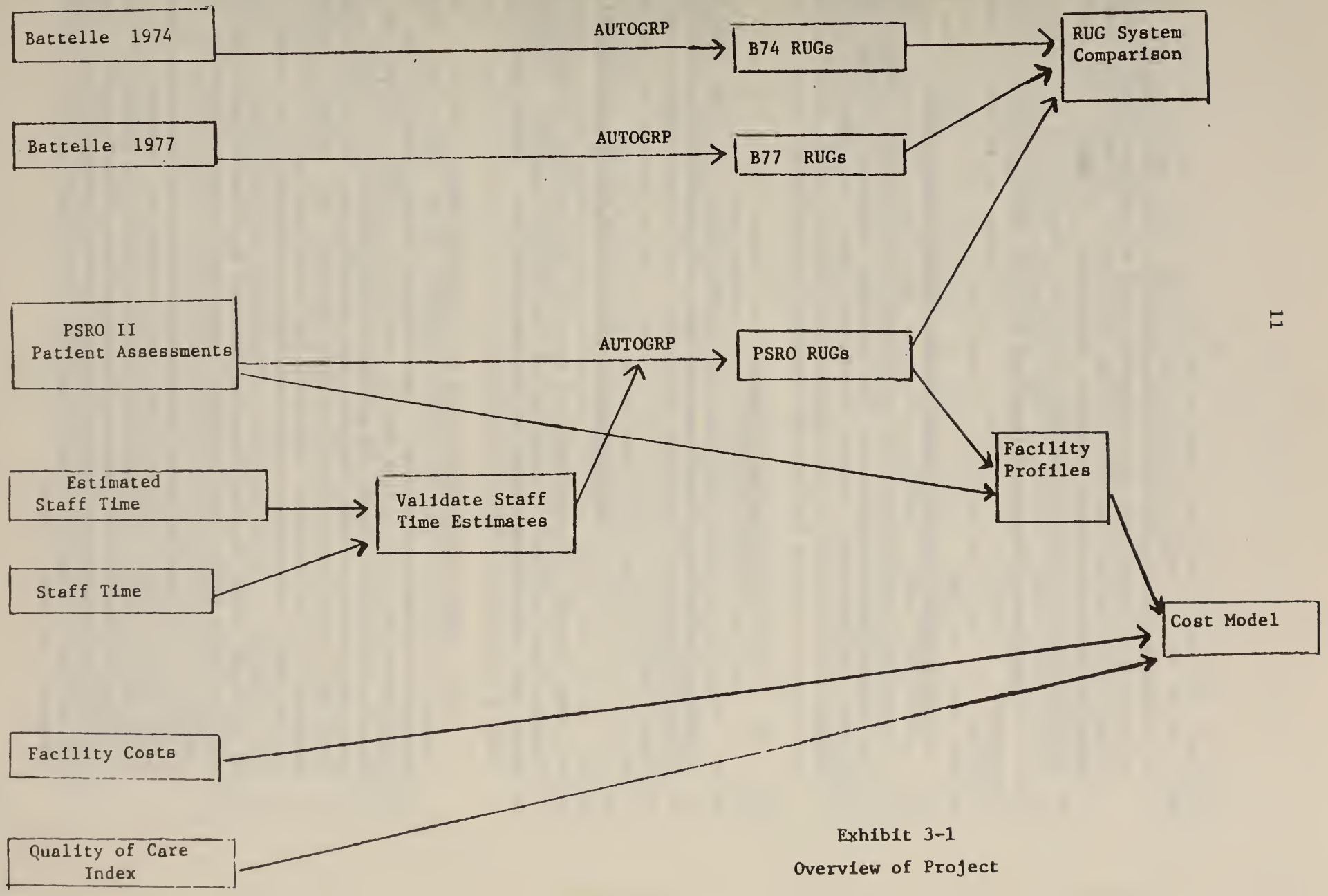


Exhibit 3-1

Overview of Project

The initial RUGs derived in this study were then used to profile the 76 facilities for which data was available, and to compare their case-mixes. Finally, the case-mix was used, along with cost, reimbursement rate, and quality of care data, in a regression analysis to determine the explanatory power of each of these variables.

The following subsections consider each of these steps in additional detail.

3.3 Data Resources for Developing Patient Classification Systems

The data used in the design of patient classification systems for LTC derived from two basic sources. The first was a series of studies performed by the Yale study team, at times in concert with the Connecticut Area II Professional Standards Review Organization (PSRO II). The second source of data were two studied performed by the Battelle Institute.

3.3.1 The Yale-PSRO II Data

Three basic sets of data were used in the design of the Yale patient classification system. These provided data on independent variables, the dependent variables, and for validation of these latter variables, respectively.

3.3.1.1 The Connecticut Area II PSRO Patient Assessments

The work of the Connecticut Area II Professional Standards Review Organization, performed in concert with the the Yale project, provided this study with an excellent source of data describing the characteristics of a large number of long-term care patients.

PSRO II was responsible for the appropriateness, quality, and the necessity of care for Federally funded patients in New Haven and Litchfield counties of Connecticut. PSRO II undertook the required Medicare and Medicaid utilization review of skilled nursing facilities in 1977. After two years experience in review of skilled nursing facility patients, a special focused review plan was developed to monitor more closely those patients whose care needs were apt to change and to decrease the number of reviews performed on permanently placed patients whose care needs were less apt to change rapidly. This focused plan depended on the reviewer's assessment of the primary reason for placement of the SNF patients. Patients were placed either for prolonged or permanent care, temporary restorative care, or temporary convalescent care. Those patients placed for prolonged care were placed primarily for (1) cognitive disability, (2) physical disability, (3) severity of medical illness, or (4) terminal care. Those patients placed for temporary restorative problems were placed for fractured hip, amputation, surgery, CVA, other fractures, or other. Patients were placed for temporary convalescent care for recuperation from acute illness or social problems. Those permanently placed patients for cognitive or physical disability were reviewed for utilization purposes only once every 12 months while other patients were reviewed as frequently as every 30 days.

Members of the staff on this project were involved from the beginning with the development of a special assessment instrument to be employed for this focused review, and, it was planned, to develop a solid data base for the future research envisioned in this study.

The PSRO II Patient Assessment Instrument was developed after intensive review of the multi-dimensional assessment instruments discussed earlier and in close consultation with the PSRO staff and nurse review coordinators who would be performing the review. The data collected was broad in scope, creating profiles of patients on a variety of dimensions. Demographic, social, mental, behavioral, and physical characteristics were all specified, as were indices of activities of daily living, diagnoses, and services rendered. In addition, individual items selected for inclusion were those for which unambiguous definitions could be written. These definitions were included in a code manual prepared for use by the PSRO nurse reviewers. This code book is included as Appendix A, and provides details both of the variables collected and of the allowable values. Inter-observer variability studies were performed and adjustments made in the code book, instructions, and instrument on the basis of these studies.

Each patient assessment was recorded on a one page form which was coded for data entry in a minicomputer-based information system developed for this project. The final format of the assessment instrument is given as Exhibit 3-2. The assessments were performed by specially trained nurse reviewers who reviewed each patient's chart, discussed the patient with the SNF staff, and observed the patient directly. Each assessment took an average of 25 minutes to complete. The same nine nurse review coordinators were involved throughout the data collection period, and frequent meetings were held to resolve any problems. From January 1980 to March 1981, a total of 17,892 patient assessment reviews were performed on a total of 8,871 patients. These reviews reported on all Federal (Medicaid and Medicare) patients in all 76 skilled nursing facilities in New Haven and Litchfield county. At any one time, Federal patients occupied 60.3% of the beds in these facilities.

3.3.1.2 Estimation of Nursing Home Staff Times

The second dataset collected for this study provided the dependent variable for the development of LTC patient clusters. It was deemed infeasible under this project's funding to collect staff time observations in numbers large enough to provide statistical significance. Instead, we collected subjective estimations of these times from the staff actually providing the service. In conjunction with the PSRO II nurse review coordinators, we designed a form to collect information both on the absolute time spent, per shift, by staff on an individual patient, as well as a relative weighting ("classification") of each patient in comparision with other patients on the facility's unit. Nurses were asked to estimate their time and the total time (nurses' plus aides'); aides to estimate their time and total time. Time estimates were in quarters of hours and the classification of relative care on a scale from 1 to 5 in intervals of 0.5. The data collection instrument is shown in Exhibit 3-3. Over a three month period, during the course of regular PSRO utilization reviews, data was collected on 1334 consecutive patients in over fifty nursing homes. In addition, Yale project staff obtained this information on an additional 135 non-Federal patients on whom objective

Exhibit 3-2
PSRO II LTC Patient Assessment Form

CONN. AREA II PSRO-LTC PATIENT ASSESSMENT FORM

PATIENT NAME | SEX ☐ 1 MALE 2 FEMALE | DOB M M D D Y Y

SOCIAL SECURITY NUMBER | RES ZIP | T18 | FACILITY | T19 | PSRO REVIEWER

CATEGORY	CODES
RACE	1. WHITE 2. BLACK 3. AM.IND/ALASKAN NATIVE 4. ASIAN/PAC ISL 5. NOT DET.
ETHNICITY	1 HISPANIC ORIGIN 2. NOT HISPANIC ORIGIN
MARITAL STATUS	1. SINGLE 2. MARRIED 3. WIDOWED 4. DIVORCED 5. SEPARATED 6 NOT DET.
PRIOR LIVING ARRANGEMENT	1. ALONE 2. W/SPOUSE 3 W/RELATIVE 4. W/OTHER 5. INSTITUTION 8. NOT DET.
RESPONSIBLE PARTY	1. SPOUSE 2. CHILD 3. SIB 4. OTHER
ATT. PHYSICIAN	
NO. OF VISITS	TOTAL CAUSE ROUTINE
TYPE/DATE OF ADM	1. FIRST ADMISSION 2. READMISSION
REVIEW TYPE/DATE	1. ADM 2. PRIV TO PEND 3. CSR T18 4. CSR T19 5. MED. STATUS CHANGE
HOSP. LOS	IN DAYS
HOSP/PAC DAYS ASGD	IN DAYS
TRANSFER FROM	1. HOME 2. GEN HOSP 3. REHAB HOSP 4. PSYCH HOSP. 5. IN AREA SNF 8. IN AREA NON-SNF 7. OUT OF AREA LTC 8. OUT OF STATE LTC
LOC/DAYS ASGD	1. SNF 2. AND 3. ICF AND 4. ICF
PAYMENT SOURCE	1. T18 2. T19 3. PRIVATE 4. PENDING T 19
LOC NEXT REV TYPE/DATE	1. CSR T18 2. CSR T19
PLACEMENT: PROLONGED / TEMPORARY RESTORATIVE / TEMPORARY CONVALESCENT	1. COGNITIVE DISABILITY 2. PHYSICAL DISABILITY 3. SEVERITY OF MEDICAL ILL 4. TERMINAL CARE 5. FX HIP 6. CVA 7. AMPUT 8. OTHER FX 9. SURGERY 10. OTHER 11. RECUPER 12. SOCIAL PROB 13. OTHER
CONTRACTURES	1. NONE 2. MODERATE 3. SEVERE

CATEGORY	CODES
DIAGNOSIS	
DECUBITUS	1. NONE 2. SUPERFICIAL 3. MODERATE 4 EXTENSIVE
MENTAL STATUS	1 CLEAR 2. MIN CONF 3. MOD CONF 4. SEVERE CONF 5 COMATOSE 8. NOT DET
SENSORY VISION/HEARING	VISION / HEARING: 1. NO LOSS (W/WO AID) 2. IMPAIRED 3. TOTAL LOSS 4. NOT DET
COMMUNICATION EXPRESSIVE/ RECEPTIVE	EXPRES / RECEP: 1. ORAL COMMUNICATION 2. LIMITED ORAL COMM. 3. TECHNICAL/PRIMITIVE COMM. 4. LANGUAGE BARRIER 5. CANNOT COMMUNICATE 6. NOT DET
BEHAVIOR PROBLEMS	CHECK ALL THAT APPLY: NONE, AGITATED, BELLIGERENT, WANDERSOME, NOISY, NOT DET.
MOOD DISTURBANCE	CHECK ALL THAT APPLY: NONE, APATHETIC/ PASSIVE, ANXIOUS, DEPRESSED, NOT DET.
RESTRAINTS	1. NONE 2. PHYSICAL 3. CHEMICAL 4. COMBINED 5. NOT DET.
SOCIABILITY W/STAFF, RESIDENTS	1. SOCIABLE 2. MIN SOCIABLE 3. SOLITARY 4. NOT DET.
SOCIAL CONTACTS	1. REG 2. OCCAS 3. NEVER 4. NOT DET. 5. N/A — SPOUSE, CLERGY, FAMILY, FRIENDS
PLANNED ACTIVITIES	1. ATTENDS MOST 2. ATTENDS FEW 3. NEVER 4. NOT OFFERED 5. NOT DET.
AMBULATION	1. IND. 2. SUPV. 3. SUPPORT 4. BED TO CHAIR CONFINED 5. BEDREST
TRANSFER	1. IND. 2. MIN ASSIST -1 3. MOD ASSIST 1 4. MAX ASSIST 2 OR MORE 5. BEDREST
WHEELCHAIR USE	1. IND 2. ASSIST 3. NOT DET. 4. N/A
CONTINENCE	BLADDER / BOWEL: 1. CONTIN 2 OCCAS INC 3. FREQ INC 4. TOTAL INC 5. INDW CATH 6. STRAIGHT CATH. 7. NOT DET.

CATEGORY	CODES
ADLS (1. IND 2. SUPV. 3. SUPP 4. TOTAL CARE 5. NOT DET.)	BATH, FEED, TOILET, DRESS, PERS. HYG.
SERVICES: DIRECT (1 DAILY, 2 (2-3/WK), 3 WEEKLY, 4 < WEEKLY)	PHYSICAL THERAPY: ROM, SPLINT ASST DEV, SPEECH THERAPY, TRANS TRAIN, WHIRLPOOL, INHAL. THER, AMB TRAIN, DEBRIDE, NONE, MUSCLE STR, OTHER, NOT DET.
SERVICES: SPECIAL	CHECK ALL THAT APPLY: NURSING REHAB, BOWEL TRAIN, BLADDER TRAIN, DIABETIC INST, OSTOMY CARE, REALITY ORIENT, THERAPEUTIC DIET, LAB, OTHER HEALTH CARE, MENTAL HEALTH, SOCIAL SERVICES, SHELTERED EMPLOY, OTHER, NONE, NOT DET.
TREATMENTS	CHECK ALL THAT APPLY: SPEC SKIN CARE, DECUB CARE, IV, O_2 THERAPY, TRACH CARE, SPEC OSTOMY CARE, INTAKE/ OUTPUT, FREQ VITAL SIGNS, STERILE DRESSING, SUCTIONING, DRUG REGULATION, NONE, MULTIPLE INJECTIONS, IRR/SPEC CATH CARE, TUBE FEEDING, WOUND CARE, CLYSIS, NOT DET
MEDICATIONS	M F R — MEDICATIONS; FREQ. 1. REG 2. PRN 3. IX; ROUTE 1. ORAL 2. PAREN 3. RECTAL 4. VAGIN 5. TOPICAL 6. OTHER
PATIENT STATUS	1. IMPROVED 2. STATIONARY 3. UNSTABLE 4. DETERIOR
QUALITY ASSURANCE PROBLEM	CHECK ALL THAT APPLY: NONE, MED CARE, NURSE CARE, OTHER

Exhibit 3-3
Subjective Time Estimation Collection Form

Last Name	First Name	Date of Birth	Facility

RN/LPN:

1. On your last shift, how much time do you estimate nurses spent caring for this patient? (include time for charting, discussing, preparation for care, etc.) ___hrs.___/4 hrs. (quarter hours)

2. On your last shift, how much time do you estimate nurses and aides together spent caring for this patient? ___HRS.___/4 hrs. (quarter hours)

3. Some patients require considerably more time than others. If we classify as "1" a patient who requires minimal time and as "5" one who requires the most time, how would you classify this patient compared with others on this floor/sub-unit?

   (Allow answers: 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5) _____

4. Is this a "special care" sub-unit? (0=No, 1=Yes) _____

AIDE:

1. On your last shift, how much time do you estimate aides spent caring for this patient? (include time for charting, discussing, preparation for care, etc.) ___hrs.___/4 hrs. (quarter hours)

2. On your last shift, how much time do you estimate aides and nurses together spent caring for this patient? ___hrs.___/4 hrs. (quarter hours)

3. Some patients require considerably more time than others. If we classify as "1" a patient who requires minimal time and as "5" one who requires the most time, how wouldyou classify this patient compared with others on this floor/sub-unit?

   (Allow answers: 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5) _____

☐ Non-Applicable Reason: _____

measures of staff time were made (see following section). Thus data on a total of 1469 patients were obtained and added to the minicomputer data base.

3.3.1.3 Observation of Nursing Home Staff Times

The third dataset describes the actual times spent by staff in facilities caring for patients, to be used to validate the subjective estimations described above. Five skilled nursing facilities were selected to include a representative sample of Connecticut SNFs. Thus the sample included one non-profit and four proprietary facilities. One of the facilities was small (70 beds), three were medium sized (approximately 100 beds) and one was large (over 200 beds).

In each facility, over a period of three days, each member of the facility's staff (aides and nurses) kept a log which included the beginning and ending times of all care they rendered to each patient on their unit. Time spend with relatives, or on tasks indirectly related to patient care (e.g., special charting, telephone conversations with physicians) was included. The duration of care rendered equally to all patients on a unit, e.g., charting, routine medication distribution, etc., was collected separately and eventually not utilized, as its inclusion would not have affect the differential time spent by staff with individual patients. A member of the Yale project staff was present in each facility throughout the study period to answer questions and monitor the data collection.

In each facility data was obtained on at least three daytime shifts as well as one night shift (see Exhibit 3-4). In the analysis we found that incomplete records prevented the analysis of one of the shifts for facilities #1 and #3: these observations were dropped from the study. For the others, we reconstructed the total time spent by each type of practitioner with each patient on the unit on each shift. In total, the actual time spent caring for 426 patients in the five facilities was obtained. A complete PSRO II patient assessment form and subjective estimates of staff time were obtained for all non-Federal patients in our sample. We therefore had both patient assessments, objective measurements of staff time, and subjective measurements of staff time on the entire sample of 426 patients.

These three datasets, together, were employed in validation and in deriving the "PSRO RUGs."

3.3.2 The Battelle Institute Data Bases

Parallel to the effort to develop from our own data a patient classification system, we duplicated our approach utilizing data from two studies performed by the Battelle Institute in 1974 and 1977.

Both studies used direct measurement of LTC facility nursing time, collected by Battelle staff in cooperation with the facility staff, and patient-related data describing the physical, functional, mental, and social capabilities of patients, their diagnoses, number and types of medications used, etc. The first study involved twelve LTC facilities "delivering quality services efficiently," and a total of 1615 individuals, whereas the later study involved sixteen facilities chosen to better represent the diversity of quality seen, and a total of 1231 patients. The data available in the 1974

Exhibit 3-4

Sample for Direct Estimation of LTC Facility Staff Times

Facility Code	Number of Shifts Observed		Total Number of Patients Observed
	Day (7 am - 3 pm)	Evening (3 pm - 11 pm)	
1	3*	1	30
2	2	1	41
	1	1	46
3	4	1*	60
	3	0	60
4	3	1	70
5	3	1	119
Total			426

* One shift with incompleted data dropped from study.

Exhibit 3-5

Patient Variables in Battelle 1974 Dataset

Variable Name	Description	Coding
Patient Characteristics		
BATH	Bathing	1=bathes w/o help, 2=bathes with help, 3=bathes with some supervision, 4=bathed entirely by others*
DRESS	Dressing	1=dresses w/o help, 2=dresses with some help, 3=dressed entirely by others
FEED	Feeding	1=eats w/o help, 2=eats with some help, 3=spoon fed by others, 4=fed by tube, 5=fed parenterally
TRANS	Transfers	1=transfers w/o help, 2=transf. with some help, 3=transf. only by others, 4=bedfast
MEDS	Number of medications	1=1-5, 2=6-10, 3=>10, 4=none
IHMEDS	Inhalation medications	1=yes, 0=no
IRMEDS	Irrigation medications	1=yes, 0=no
ISMEDS	Instillation medications	1=yes, 0=no
IVMEDS	Intravenous medications	1=yes, 0=no
OMEDS	Oral medications	1=yes, 0=no
PMEDS	Parenteral medications	1=yes, 0=no
RMEDS	Rectal medications	1=yes, 0=no
TMEDS	Topical medications	1=yes, 0=no
BLADDER	Bladder function	1=no problem, 2=retention, 3=involuntary loss
BOWEL	Bowel function	1=no problem, 2=impactions, 3=involuntary loss
BBTRAIN	Bowel and bladder training	1=yes, 0=no
OSTCARE	Ostomy	0=none,1=self care, 2=not self care
INCATH	Indwelling catheter	0=none,1=self care, 2=not self care
EXTDEV	External device	0=none,1=self care, 2=not self care
CBSDX	Chronic brain syndrome	1=yes, 0=no
NERVDX	Disease of nervous system	1=yes, 0=no

Exhibit 3-5(cont.)

DEPRESS	Depressed	1=yes, 0=no
DISORIEN	Disoriented	1=yes, 0=no
PABUSE	Physically abusive	1=yes, 0=no
VABUSE	Verbally abusive	1=yes, 0=no
WANDER	Wanders	1=yes, 0=no
FORGET	Forgetful	1=yes, 0=no
RESTRAIN	Restraints	1=yes, 0=no
UNRESP	Unresponsive/withdrawn	1=yes, 0=no
WTHDRAWN	Withdrawn	1=yes, 0=no

Staff Time

AIDETIME	Aide time	minutes per patient day
NURTIME	Licensed nurse time	minutes per patient day

---

* Note that this variable, as with a few others, has variable values that cannot be placed in order or severity, or have orders that are different than that dictated by severity.

dataset is listed in Exhibit 3-5. For the 1977 dataset most of the variables were identical except for the following changes: the variables for oral medications, bowel function, and bladder function were dropped and replaced by a variable for bowel&bladder training and one for teaching/training required; and the coding of toileting independence was enlarged.

Each of the Battelle datasets was used, independently, to derive a patient classification system, denoted B74 RUGs and B77 RUGs, respectively.

3.4 Development of Resource Utilization Groups

The major goal of this project was to derive groups of patients who require similar resources in LTC facilities. These groups were formed by clustering the observations in the data bases so that the variations in the dependent variables (measures of resource utilization) were best explained, with the clusters formed employing the independent variables representing patient characteristics. It is important to emphasize that only patient characteristics are used; defining groups on the basis of facility characteristics such as ownership, staffing patterns, etc. would make it necessary to control for these variables or carefully account for differences in the sampling frame. For example, while differences in staffing patterns from facility to facility may alter the absolute time available to different patients, the relative consumption of time between patient groups would not vary. Groups were formed on the basis of actual resource consumption; we did not plan to hypothesize what care might or even ought to be given to patients.

Three criteria were followed in the formation of the LTC patient classification systems in addition to statistical rationale. First, the groups must be meaningful as categories of patients identifiable by practitioners of geriatric care as requiring similar management. A major hypothesis is that although practitioners might differentiate patients on a large number of variables, in fact these variables are "overlapping," and a much smaller subset of variables would suffice. For example, the variables describing Activities of Daily Living focus on different aspects of patients' functional capabilities, but if a patient needs total assistance in feeding, then it is unlikely he or she will be able to ambulate without significant assistance.

Secondly, only variables readily available and identifiable by practitioners were used, and, thirdly, the systems had to consist of a manageable number of groups.

The first and third criteria were satisfied by careful definition of the groups; the second was considered in our choice of patient characteristics.

The methodology used to accomplish the RUG classification was cluster analysis based on Automatic Interactions Detection. In clustering, the full set of data points is recursively partitioned into subgroups by a set of splits, each split based on the values of a particular independent variable and chosen so that the predictive error of the dependent variable is minimized. Subgroups are designated terminal groups when they cannot be partitioned further because either sample sizes are too small or else little benefit in reducing variance would be obtained. With sample sizes in the three data bases used for grouping each of around 1600 observations, we did not

split terminal groups with 40 or fewer observations, or which provided less than a 1% reduction in variance.

The result of our AUTOGRP analyses are "trees" describing clusters of patients. A sample tree is shown in Exhibit 3-6. The entire population initially is "split" on Variable A; the first group might consist of 50 patients with values of 1 or 2 for this variable, the second group of 100 with a Variable A value of 3, and a third group of 80 patients with value 4. For each group the mean value of the dependent variable is indicated as well as the within-group standard deviation. It should be noted that after each split these standard deviations are reduced. This variance reduction is the statistical goal of AUTOGRP.

In this hypothetical example, the first group does not benefit by further partitioning, and become a "terminal" group (i.e., a patient cluster. The second group is partitioned on Variable B into three terminal groups, the third group by Variable C into two terminal groups. Together, the six patient clusters represent a patient classification system.

It is important to recognize that the AID methodology allows different subgroups to be split on different variables. For example, patients who are able to feed themselves may be partitioned according to whether or not they are able to ambulate, while patients totally dependent in feeding may be divided according to whether or not they are confused. This aspect of clustering is important when it is compared with other methods used to develop classification systems, such as the regression analysis (see, for example, McCaffree et al.[44] and Caviolla and Young[45]) in which patient groups or indicies of patient classifications are uniformly based on the same set of variables.

The choice of independent variables to be used to make these splits and the order in which to involve these variables is based both on statistical grounds (higher variance in staff time explained) and on inherent meaningfulness, as determined by the LTC experts in our group. That the user can interact with the statistical process is important in making the groups conceptually meaningful. For example, in a few instances AUTOGRP suggested a split into groups which combined patients who were totally dependent and totally independent, leaving for a second group those who were partially dependent; in many instances such a "split" would be unreasonable. In other cases, several variables potentially could be used to significantly reduce the variance in a group, and the choice could be based on the clarity with which the variable was defined, and its meaningfulness in the particular context.

Subjective estimates used to create the dependent variable and PSRO II patient assessments (the source of independent variables) were completed on a total of 1469 patients. In all cases we took only the PSRO II Assessment closest in time to the subjective estimation (because of the timing of the data collection, this was always the most recent review for each patient.

The variables we used in forming the PSRO RUGs were those patient-oriented data items obtained in the PSRO patient assessment reviews (Exhibit 3-2), and, in a few cases, variables derived from these basic data items. For example, of particular interest in this study was the relevancy of diagnosis in determining resource consumption of patients. As the order in

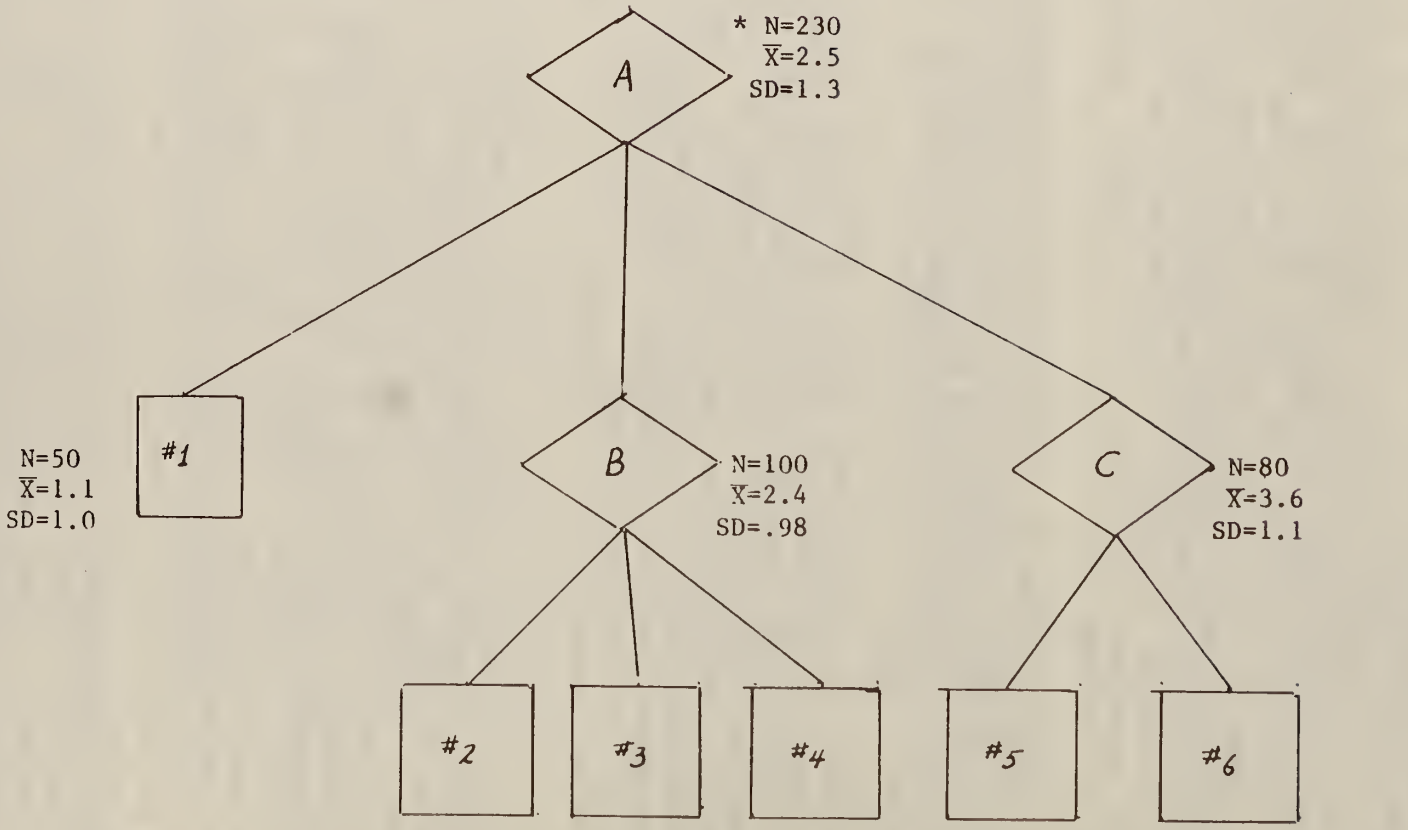


Exhibit 3-6

Hypothetic Clustering Tree

which diagnoses were coded was not considered reliable, we coded diagnoses for each patient independent of order. We felt that if diagnosis was to be a useful patient characteristic, it would have to be by its inclusion in a group of similar diagnoses. Thirteen diagnostic categories were constructed by the geriatrician of the project, including all of the primary diagnoses listed for the 1,469 patients in the study. These categories sometimes cut across ICD-9 categories, as the diagnoses were grouped together on the basis similarity of functional and care needs. For example, in the category Neurological Motor Dysfunction were included patients with CVA's, multiple sclerosis, spinal cord injury, and Huntington's chorea, among others. The thirteen categories formed were: dementia, neurological motor dysfunction, psychosis, muscular skeletal disability, cardiac disease, pulmonary disease, neoplasms, urinary tract disorders, gastrointestinal disorders, eye disorders, skin disorders, endocrine disorders, and peripheral vascular disease. Exhibit 3-7 lists the ICD-9 codes included in each of these thirteen groups.

We examined a yes-no variable for each of the thirteen diagnosis groups and two additional variables formed by combining one or more of the neurological classifications. A third diagnostic variable formed was the number of these thirteen groups recorded for each patient, a possible measure of the number of major physical problems the patient had or his/her relative "illness."

In clustering the 1974 and 1977 Battelle data, we were limited almost exclusively to the variables available in each -- 30 and 29 variables, respectively. Few combinations of variables made sense. The 1974 dataset contained 1615 observations, the 1977 dataset 1245. However, with a fairly broadly ranging dependent variables of actual staff time, we did determine "trim points," isolating the top values for special study. The trim points were determined by direct evaluation of histograms. In the 1974 data 56 patients with either aide or nursing time more than 2.5 standard above the mean were trimmed and in the 1977 data 44 points with approximately 2.5 standard deviation above the mean in either nurse or aide time were identified. Both the 1974 and 1977 datasets were analysed both including all patients and excluding those with the identified outlying values the "untrimmed" and "trimmed" datasets, respectively. We also evaluated those patients identified as outliers individually.

In addition, we formed patients clusters using both aide and nurse time as the dependent variable. For reasons discussed later, our results were derived mainly using aide time as a dependent variable.

3.5 Comparison of Patient Classification Schemes

The AUTOGRP analysis was performed, separately, three times. From the PSRO-derived variables we obtained the "PSRO RUGs," and from the 1974 and 1977 Battelle datasets we derived the "B74" and "B77 RUGs." We expected that these three classification systems would not appear de facto the same, i.e., that different independent variables would by chance be used in each system. However, a major question was not whether the same variables were used, but whether the three systems would in fact give different results when applied to a management problem or to developing a facility profile. It would be sufficient (but not necessary) if it could be shown that the same patients would be grouped together in each system.

Exhibit 3-7

Diagnostic Categories with Associated
ICD-9 Codes

CATEGORY #1 - DEMENTIA

Nonpsychotic brain syndrome NOS	3109
Senile dementia	2900
Mental retardation NOS	319
Presenile dementia	29010
Senility without psychosis	797
Down's Syndrome	7580
Alzheimer's Disease	3310
Obstructive hydrocephalus	3314

CATEGORY #2 - NEUROLOGICAL MOTOR DYSFUNCTION

CVA	436
Multiple sclerosis	340
Cerebral artherosclerosis	4370
Paralysis agitans	3320
Cerebrovascular Disease NOS	4379
Hemiplegia NOS	3429
Cerebral palsy NOS	3439
Traumatic subarachnoid hemorrhage	85200
Cerebral artery occlusion NOS	4349
Coma & stupor	7800
Brain injury NEC.	85400
Paralysis NOS	3449
Encephalopathy NOS	3483
Spinal cord injury NOS	9529
Late Effects of Cerebrovascular disease	438
Non-ruptured cerebral aneurysm	4373
Transient cerebral ischemia NOS	4339
Acute infectious polyneuritis	3570
Quadriplegia NOS	3440
Cerebral degeneration NEC.	33189
Hemiplegia	342
Subarachnoid hemorrhage	430

Exhibit 3-7 (pg. 2)

CATEGORY #2 - NEUROLOGICAL MOTOR DYSFUNCTION (continued)

Hereditary progressive muscular dystrophy	3591
Cerebral embolism	4341
Mononeuritis NOS	3559
Basilar artery syndrome	4350
Diabetic neuropathy manifested in adult	25060
Cerebral thrombosis	4340
Vertebral artery syndrome	4351
Huntington's Chorea	3334
Cerebellar ataxia NEC	3343
Spinal cord disease NOS	3369
Meningitis NOS	3229

CATEGORY #3 - PSYCHOSIS

Schizophrenia NOS	29590
Psychosis NOS	2989
Paranoid state NOS	2979
Manic depressive NOS	29680
Depressive disorder NEC	311
Neurotic depression	3004
Adjustive reaction	3099
Neurotic disorder	3009
Anxiety state NOS	30000
Reactive depression psychosis	2980
Schizophrenia NOS CHR	29592

CATEGORY #4 - MUSCULOSKELETAL DISABILITY

Fr neck of femur NOS	8208
Osteoarthritis NOS - unspec	71590
Fx femur NOS - closed	82100
Oth acq limb deformity	73689
Rheumatoid arthritis	7140
Pelvic fracture NOS	8088
Arthropathy NOS - unspec	71690

Exhibit 3-7 (pg. 3)

CATEGORY #4 - MUSCULOSKELETAL DISABILITY (continued)

Amputation leg - unilateral NOS	8974
Vertebral Fx NOS - closed	8058
Humerus NOS - closed	81220
Fx ankle NOS - closed	8248
Fx tibia NOS - closed	82380
Fx tibia and fibula NOS	82382
Late amputation complication NOS	99760
Fx fibula NOS - closed	82381
Fx carpal bone NEC - closed	81409
Contusion of hip	92401
Idiopathic scoliosis	73730
Forearm deformity NOS	73600

CATEGORY #5 - CARDIAC DISEASE

Coronary atherosclerosis	4140
Atherosclerosis NOS	4409
Congestive heart failure	4280
ASCVD	4292
Hypertension NOS	4019
Atriovent block complete	4260
Myocardial infarct NOS	4109
Hypertensive heart disease NOS	40290
Acute lung edema NOS	5184
Sinoatrial node dysfunction	42781
Heart disease NOS	4299
Premature Beats NEC	42769
Myocarditis NOS	4290
Cardiac dysphythmia NOS	4279
Atrial fibrillation	42731
Aortic valve disorder	4241
CHR ischemic heart disorder	4149
Angina pectoris	4139
Acute ischemic heart disorder NEC	4118
Cardiac arrest	4275

Exhibit 3-7 (pg. 4)

CATEGORY #6 - PULMONARY DISEASE

Pneumonia organism NOS	486
CHR airway obstruction NEC	496
Food/vomit pneumonitis	5070
Bronchitis NOS	490
Acute URI NOS	4659
Pulmonary embolism/infarct	4151
Pulmonary congest/hypostasis	514
Broncopuemonia org NOS	485
Pulmonary TB - NOS - unspec	01190
Postinflammatory pulmonary fibrosis	515
Pulmonary eosinophilia	5183
Late effect TB, respiratory/NOS	1370
Hemoptysis	7863

CATEGORY #7 - NEOPLASMS

Malignant neoplasm colon	1539
Malignant neoplasm breast	1749
Malignant neoplasm corpus uteri	1820
Malignant neoplasm rectum	1541
Malignant neoplasm NOS	1991
Leukemia - unspec cell NOS	2089
Malignant neoplasm head/face/neck	1950
Malignant neoplasm bronch/lung NOS	1629
Malignant neoplasm bladder NOS	1889
Malignant neoplasm skin NOS	1739
Bone/skin neoplasm NOS	2392
Brain neoplasm	2397
Malignant neoplasm stomach NOS	1519
Benign neoplasm lymph nodes	2290
Malignant neoplasm lymph-axilla/arm	1963
Malignant neoplasm sigmoid colon	1533
Lymphoma NEC lingual tonsil	1416
Hodgkin's Disease NOS unspec	20190
Malignant neoplasm ovary	1830

Exhibit 3-7 (pg. 5)

CATEGORY #8 - URINARY TRACT DISORDERS

Urinary tract infection	5990
Hyperplasia of Prostate	600
Nephroptosos	5930
Neurogenic bladder	34461
Retention of urine	7882
Hematuria	5997
Urethral stricture NOS	5989
Renal urethral disorder NOS	5939
Calculus of kidney	5920
Chronic renal failure	585

CATEGORY #9 - GASTROINTESTINAL DISORDERS

Gastrointestinal hemorrhage NOS	5789
Diverticulitis of colon	56211
Cholecystitis NEC	5751
Intestinal obstruction NOS	5609
Rectal anal hemorrhage	5693
Duodenal ulcer NOS	53290
Diaphragmatic hernia	5533
Cholelith with cholecystitis NEC	57410
Dysphagia	7872
Alcohol cirrhosis liver	5712
Hepatic coma	5722
Idiopathic proctocolitis	556
Disease of gall bladder NOS	5759
Acute pancreatitis	5770
Liver disease NOS	5739
Cholelithiasis NOS	57420
Chronic pancreatitis	5771
Idiopathic proctocolitis	556
Impaction intestine NEC	56039
Acute necrosis of liver	570
Abdominal pain	7890
Diverticulosis of colon	56210
Irritable colon	5641

Exhibit 3-7 (pg. 6)

CATEGORY # 9 - GASTROINTESTINAL DISORDERS (continued)

Enterostomy malfunction	5696
Atrophic gastritis	5851
Gastritis/duodenitis NOS	5355
Stomach ulcer NOS	53190

CATEGORY #10 - EYE DISORDERS

Cataract NOS	3669
Senile cataract	36610
Glaucoma	3659

CATEGORY #11 - SKIN DISORDERS

Decubitus ulcer	7070
Cellulitis	6829
Chronic skin ulcer	7079
Carbuncle NOS	6809
Burn	9490
Cellulitis of leg	6826
Late effect of burn	9069
Sebaceous cyst	7062

CATEGORY #12 - ENDOCRINE DISORDERS

Diabetes uncomplicated - adult	25000
Thyrotoxicosis	242

CATEGORY #13 - PERIPHERAL VASCULAR DISEASE

Peripheral vascular disease NOS	4439
Gangrene	7854
Thrombophlebitis	4519
Peripheral vascular anomaly NEC	7476
Venous thrombosis	4539

Such an approach, suggested by Klastorin,[46,47] was applied here. We began with a data base containing for each pair of patients all the variables used to determine his/her classification group in each of two systems. Each pair of patients was considered in turn and we determined whether the pair was in the same or different groups in each of the two systems. If the systems are concordant, then it can be expected that pairs of patients who are in the same group in one system will be in the same group in the other, and, conversely, pairs of patients in different groups in one system will be in different groups in the second. Counting the number of times pairs are in the same or different groups under the two systems, the results can be displayed in a 2x2 table as shown in Exhibit 3-8, and a measure of concordance can be derived from the standard Kappa statistic for a 2x2 table and its associated Normal distribution.[48] With three systems we had a total of three comparisons which could be made, and we made each of these comparisons using each of the three data bases (PSRO, Battelle 1974 and Battelle 1977).

3.6 Facility Profiles and Cost Analyses

The derivation of groups of patients with similar resource consumptions, at least as measured by staff time or staff time estimates, provides a preliminary case-mix measure for a facility. Either the distribution of case types in each facility can be examined, or, to make evaluation more manageable, the proportions of patients in each group can be collapsed into a single measure. If w(i) is the weight (case intensity) assigned to RUG i, and p(i) is the proportion of patients of the facility in RUG i, then the average case-mix for a facility is given by the weighted average, i.e., $C = \sum w(i)\, p(i)$. The weights can be obtained by evaluating for each of the RUGs the average (for that RUG) of the dependent variable or any other measure of case care needs. Here, we had three data bases (the PSRO and two Battelle data) from which to compute weights. Given three RUGs and three data bases from which to derive weights, a total of nine possible univariate case-mix measures for a facility could be derived. Although we examined all nine, we found little difference, and decided to use each RUG with weights derived from the PSRO data base -- again a total of three systems. We then compared these three systems by contrasting the values obtained by each for the 76 facilities in the New Haven and Litchfield Counties, as well as taking the Pearson Correlations between these values.

During the development of the Resource Utilization Groups, one of the staff supported by this project was involved with a detailed analysis of costs in Connecticut nursing homes. This work lead to a Masters' Thesis, available separately. The basic methodology of this work is outlined here.

Since 1975 Connecticut has required that nursing homes report their costs on a uniform basis. The ce cost data used was for 1978, the latest availabl e at the time the initial study was performed. Multiple regression analysis permitted the determination of those factors explanatory of cost differences between facilities. In particular, the dependent variable used was average operating cost per patient, defined as the total expenditures of the facility less debt service (depreciation, amortization, and interest) and property taxes, divided by the total patient days. Independent variables included measures of capacity (number of beds), occupancy, ownership, level of care,

Exhibit 3-8

Structure of the Analysis of
Concordance of Classification Systems

		System A Assigned to same group		
		Yes	No	Totals
System B Assigned to same group	Yes	n 11	n 12	n 1.
	No	n 21	n 22	n 2.
	Totals	n .1	n .2	n ..

payment source, etc. A full list of the variables considered is given as Exhibit 3-9. One explicit goal of this study was to examine whether or not economies of scale would be seen, after adjusting for these other variations between facilities. Thus special attention was given to the importance and impact of variables associated with the number of patient days, evaluated either by examining the coefficient and statistical significance of these variables in the regression equation, or by evaluating the relationship between the residuals of the best regression equation (excluding these variables) and these variables. The regression analysis was first performed on the 63 Skilled Nursing Facilities in the PSRO II area, then the results checked for robustness in the state-wide data base of 208 facilities. Additional details of the methodology are available in the attached report.

The results obtained by Stratton were directly of use in this study to evaluate the effect of case-mix after having controlled for other variables affecting cost. As Stratton indicates, a major gap in the ability to develop appropriate cost explanations is the lack of a measure of case-mix. We therefore included the facility case-mix index as a variable in regression equations to explain average cost per patient day, adjusting the cost for those variables already determined in the earlier study as being influential in explaining cost differentials. Hopefully, case-mix would be found to be significantly and positively correlated with cost. The lack of case-mix measures for all state facilities restricted the analysis to the 63 facilities in the PSRO II area.

Exhibit 3-9
Variables Used in Regression
Analysis of Cost

Independent Variable	Abbreviation	Measure(s)	Hypothesized Associations With Dependent Variable	Comments
Output	PDTOTAL	1. Total Patient Days	Direction Depends On Functional Form of Model	Economies of Scale
	PDSQUARE	2. Patient Days Squared		
	PDCUBE	3. Patient Days Cubed		Measures 2 and 3 test for U-shaped Long-run average cost function
Capacity	ENDBD	Number of SNF beds (arbitrarily used end of year, hence "ENDBD")	negative	Economies of Scale (high probabili of multicollinearity with PDTOTAL if occupancy rates are high)
Utilization of Productive Capacity	OCC	1. Occupancy Date	negative	No diminishing marginal returns
	CAPDEV	2. Deviation in capacity from 30 bed multiple (also tried as dichotomized)	positive	Staffing minimum were based on 30 - bed units
Ownership	OWN	1. For - profit vs not--for profit		for - profits < not - for profits (profit incentive)
	OWNER	2. Individual, proprietary, corporation, other, voluntary, government, voluntary corporation	1 Levels	unknown if the types of for-profit might differ significantly from each other
LEVEL OF CARE	LEVCARE	1. Single vs multilevel	2 Levels	Multilevel < Single level
	LEVEL	2. SNF, SNF, + ICF, SNF + HA, SNF + ICF + HA	4 Levels	Possible economies of administrati as well as in ancillary and support services)
Payment Source	PCT PRIV	1. Percent private / self pay days	positive	Medicaid reimburses at lower rates; cross- subsidization
	PCTMAID	2. Percent Connecticut Medicaid days	negative	
	PCTMOTH	3. Percent Medicaid (other states) days	negative	
Managerial	RECTURNP	1. Receivables turnover ratio (patient accounts)	negative	higher turnover improves cash-flow and thus reduces need for for short-term borrowing
Effectiveness	RECTURNT	2. Receivables turnover ratio (all receivables)	negative	
	HEATBED	2. Heating - cost per bed	positive	use of energy conservation

Exhibit 3-9

Independent Variable	Abbreviation		Measure(s)	Hypothesized Association with Dependent Variable	Comments
Input (Factor) Prices	HSA	1.	Health Service Area	5 levels	Cost of living higher in urban areas, especially near New York City.
	SMSA	2.	Standard Metropolitan Statistical Area (also tried dichotomized)	13 levels	SNFs nearer New York City should have higher factor prices.
	CENTCITY	3.	Central City (also tried dichotomized)	13 levels	Ready availability of unskilled (hence, cheaper) labor; more so than in rural or other urban areas.
	UTIBED	4.	Utilities (light, power, water) expense per bed	positive	Less amenable to managerial control difficult to "shop around"
Intensity and Quality of Care	NURSDY	1.	RN and LPN and aides salaries per patient day (excludes Director of Nursing)	positive	May reflect quality, casemix, and possible differences in factor prices.
	FOODDAY	2.	Raw Food Cost per patient day	positive	May reflect quality/casemix (special diets) differences; used by some HSA
	QUALFOO	3.	Quality of Care Index (developed by B. Foohay, Yale MPH)	negative	The more "demerits" the higher the index value. Quality is a cost (in an economic sense, at least)
(QUALDIM)	QUALCT	4.	Index adapted from Foohay's index by State Department of Health	negative	Like QUALFOO, this is intended to be a structural measure of quality of care.
			DEPENDENT VARIABLES		
	SNFAOC		Average operating cost defined as (Total Cost - Debt Service - Property taxes) / Total Patient Days		Our main interest in the regression analyses (Abbreviated in the computer printouts as SNFATCV2)
	SNFATC		Average Total Cost (Total Cost/Total Patient Days)		Used primarily for analysis of the components of average total cost

4. Findings and Results

The analyses described in the previous section were performed in the period from November 1981 through October 1982. We describe first the analysis of the data collected during this project — the PSRO II patient assessments, and the subjective and objective measurements of nursing home's staff time — then the analysis of the two datasets obtained from the Battelle Institute. Finally, we report on the comparisons of results obtained from these sources, their use in developing a case-mix measure and determining cost in New Haven and Litchfield County Skilled Nursing Facilities.

4.1 Evaluation of Subjective Estimation of Nursing Home Staff-Time

A goal of this study was to examine the feasibility of using nursing home staff's estimations of their time spent caring for patients. This was used as a surrogate for actual time spent, since time-and-motion and work-sampling studies are expensive and intrusive.

As described earlier in the methodology section, estimates of the amounts of time required to care for each of 1469 patients were obtained from the aides and nurses caring from them. Almost all of these estimates were obtained during the course of regular PSRO utilization review. Exhibit 4-1 displays characteristics of these estimates.

Not unexpectedly the distribution of estimated nurse time had higher variability than that of aide time. This is see by the higher coefficient of variation (the standard deviation divided by the mean): 1.3 for nurses and .77 for aides. The distribution of patient classifications of workload was not skewed towards maximal care, as might have been expected, but rather distributed approximately normally across the five categories (see Exhibit 4-2). We felt therefore, that these estimates were a serious and objective attempt by the SNF staffs to appropriately classify the relative care needs of their patients.

Objective measures of the actual time spent by staff caring for patients were obtained for 426 patients, a subset of the 1469 patients on whom subjective estimates were available (Exhibit 4-3). For these patients, data was thus available on both the subjective estimation of staff time and an objective measurement from an actual time study.

The objective data used for the comparisons were the staff times (nurse, aides, and combined) for the day shifts only, averaged over the number of shifts. (Night shifts were not considered as the total number of patient-shifts recorded was low.) The subjective estimates and actual times were compared by evaluating the Pearson correlations. No difference in results occured if the observations were unweighted, or weighted by the number of shifts.

Correlations between the objective and subjective measures are displayed in Exhibit 4-4. Combining the nurses' and the aides' classifications resulted in an average classification variable which correlated well with both the aide time (.55) and with total staff time (.57). Similarly, aides' classifications of total time correlated well with their actual times (.49). In contrast, the

Exhibit 4-1

Characteristics of Subjective Estimates and Classifications of Staff Time

	Mean	Median	Standard Deviation
Classification of relative time			
By nurses	3.24	3.0	1.21
By aides	3.30	3.0	1.28
Average Classification	3.27	3.25	1.14
Estimation of time			
By nurses, of nursing time	.74	.50	.76
By nurses, of total time	1.73	1.50	1.22
By aides, of aide time	1.21	1.00	.93
By aides, of total time	1.75	1.50	1.30

Exhibit 4-2

Distribution of Classifications of Staff Workload

Range	Nurses	Aides	Total
1-<2	10.5%*	11.7%	12.4%
2-<3	19.7	18.6	22.0
3-<4	31.3	28.7	31.5
4-<5	20.2	19.5	21.5
5	18.2	21.5	12.6

*Percentages may not add to 100% due to rounding; n=1469.

Exhibit 4-3

Objective Measurement of Staff Time

	Observations	Mean	Standard Deviation
Day Shift			
Nurses	1115	11.45	12.80
Aides	1115	34.90	25.79
Night Shift			
Nurses	366	8.32	9.38
Aides	366	19.05	14.40

Exhibit 4-4

Pearson Correlations** Between Subjective and Objective Measures of Staff Time

	Objective Measures***		
Subjective Estimates	Nurse Time	Aide Time	Total Time
Classification of relative time			
By nurses	.27		
By aides		.49	
Average Classification	.25	.55	.57
Estimation of time			
By nurses, of nursing time	.20		
By aides, of aide time		.11*	
Total time (average of aide and nurse)			.20

* Significant at the 5% level; all other values significant at the .001 level

** Weighted by number of shifts

*** Day shifts

classifications did not correlate well with actual nursing time (.27 and .25), a result not surprising in light of the fact that the majority of patient care in nursing homes is provided by aides. For example, the 1983 National Academy of Sciences study on nursing reports that while registered nurses comprise 46% of a hospital nursing staff and aides 23%, in nursing homes registered nurses comprise 15% of the staff and aides 71%.[49]

Direct estimation of nursing and aide time was expectedly less successful, since it is generally agreed that direct estimation of time spent is not accurate. This results, at times, in direct estimates that exceed the total time of the shift, are more heterogeneous than appropriate, etc. Although our study design precluded evaluating these phenomena, the lack of correlations seen between different staff time estimates and actual were representatively low (.20 and .11).

It should be noted that all the correlations shown represent statistically significant relationships (at the 0.1% level, except for the r=.11 correlation between aide time estimates and actual, significant at the 5% level). Nevertheless, correlations substantially higher than just significant were considered essential for the success of this study.

In summary, we found that nurses and aides did a good job estimating the relative intensity of care required by their patients. They placed patients evenly along the scale from light to heavy care, and this classification correlated well with measured staff time. We thus concluded that this combined (nurses and aides) classification of intensity of patient care requirement was a reasonable dependent variable describing resource consumption by nursing home residents.

4.2 The PSRO II Resource Utilization Groups

On the strength of the results above, the combined nurses and aide classification of relative patient care requirements was used as the dependent variable. The independent variables, patient characteristics, were used to explain the differences seen in this measure of resource consumption. An Automatic Interactions Detection program was used to determine clusters of patients with similar measures of staff time, as described in Section 3.

The set of 1469 patients on whom we had both a PSRO II assessment and a subjective estimation of care time requirements constituted the database for the AUTOGRP analysis. For the total group of 1469 patients, the mean classification of patient care needs, recorded on a scale from 1 to 5, was 3.22 and the standard deviation 1.16. All the variables included in the PSRO II dataset were then examined to determine their ability to reduce the variance in this dependent variable. Exhibit 4-5 displays the reductions obtained if each variable in the data was used for the initial decision upon which to partition the 1469 patients.

Nine variables, all describing physical ability, individually provided more than 20% reduction in variance. These included the Activity of Daily Living scale variables for toileting, dressing, personal hygiene, and feeding (all except for bathing, which provided only slightly less reduction -- 15%), along with ability to ambulate, transfer from bed to chair, and continence of

Exhibit 4-5

Initial Reduction in Variance of Average Time Classifications for PSRO Dataset

Variable Name	Variable Description	Number of Groups	Percent Reduction
ATOILT	Toilet	3	28.6%
ADRESS	Dress	3	28.5
APERSH	Personal Hygiene	3	28.4
AMBULE	Ambulation	4	27.8
TRANSF	Transfer Ability	4	26.0
CONTBL	Continence-Bladder	3	23.8
AFEED	Feed	3	22.6
CONTBO	Continence-Bowel	3	20.6
INCONT	Total Bowel/Bladder Continence, Catheter	2	20.3
ABATHE	Bathe	2	14.9
RSTRNT	Restraints	2	11.2
COMREC	Communication Receptive	3	10.0
PLNACT	Planned Activities	3	9.3
COMEXP	Communication Expressive	2	8.9
MNSTAT	Mental Status	3	7.9
PLREAS	Reason for Placement	3	7.7
IO	Intake/Output Monitoring	2	7.6
DECUBT	Decubitus	2	7.3
SCSTAF	Sociability	3	7.3
REHPOT	Rehabilitation potential	2	5.2
COMMUN	Cannot Communicate	2	5.1
CLFEED	Tube or Clysis Feeding	2	4.9
DECUBC	Decubitus Care	2	4.7
PTSTAT	Patient Status	2	4.6
TBFEED	Tube Feeding	2	3.9
PAYSRC	Payment Source	2	3.8
SPSKCR	Special Skin Care	2	3.6
WHEEL	Wheelchair Use	2	2.9
ISCATH	Irr/Spec Catheter Care	2	2.8
SPOUSE	Social Contact (Spouse)	2	2.5
SENSVS	Sensory Vision	2	2.5
TRNFRM	Transfer From	2	2.4
RESPRT	Responsible Party	2	2.2
SENSHR	Sensory HEaring	2	1.8
MRSTAT	Marital Status	2	1.7
PRLVAR	Prior Living Arrangement	2	1.6
SCTION	Suction	2	1.5
ROM	Range of Motion	2	1.4
VISTOT	Total Visits	2	1.3
FRVITS	Frequent Vital Signs	2	1.2

Exhibit 4-5 (Cont.)

The remaining variables did not provide variance reductions in excess of 1.0%:

SOTHER	Other Special Care
WNDCAR	Wound Care
BNONE	No Behavior Problem
NREHAB	Nursing Rehabilitation
BNDET	Behavior Problem (N.D.)
APATHY	Apathy
AGE	Age
SOCSER	Social Service
MUSTRN	Muscle Training
DEPRESS	Depressed
MNDET	Mood Disturbance (N.D.)
FAMILY	Social Contact (Family)
FRIEND	Social Contact (Friend)
CLERGY	Social Contact (Clergy)
PSEX	Sex
ANXIOS	Anxious
AMTRAN	Ambulation Training
WANDER	Wandersome
REALOR	Reality Orientation
NOISY	Noisy
BELLIG	Belligerent
OXYTHR	Oxygen Therapy
TRAIN	Muxcle, Ambulation or Transfer Training
MHEALTH	Mental Health
TRTRAN	Transfer Training
STDRES	Sterile Dressing
F1TOT	Total Medications
RACE	Race
TYPADM	Type of Admission
THDIET	Therapeutic Diet
MNONE	No Mood Disturbance
FR1TOT	Medication Route Total
LAB	Laboratory Tests
OHELTH	Other Health Care
AGITED	Agitated

n=1496

bladder and bowel. Three more variables provided reductions of from ten to fifteen percent: independence of bathing, use of restraints and ability to communicate -- the only behavioral variable in the top dozen. The physical capability variables have been found in prior studies to be important predictors of resource consumption.[50-54]

The variable employed to initially partition the full sample of 1469 patients, DRESS, was chosen for a combination of reasons. First, it had close to the highest explained variance and achieved this using only three groups. Furthermore, other variables, when used for this initial split, provided classification systems less satisfactory on intuitive grounds, for example, with secondary splits what made less sense or poorer total reduction for the full classification system. In particular, we developed systems with initial split based on the nine variables with the highest explained variance, as well as with variables identified by project staff as important: mental status, behavioral variables, and type of placement.

The partitioning process resulted in the construction of a patient classification scheme consisting of nine patient categories or PSRO Resource Utilization Groups (PSRO RUGs). Each group is defined by patient attributes including independence in dressing (DRESS), independence in feeding (FEED), ability to ambulate (AMBUL), and whether intake and output of fluids is monitored (INTAKE/OUTPUT). Exhibit 4-6 lists the variables involved in defining this system. The result of this interactive, reiterative classification process is diagramed in Exhibit 4-7. In such a "tree," diamond-shaped figures represent decision nodes and contain the name of the variable used in splitting patient groups. Lines (branches) emanating from the diamonds are labeled with variable values and lead either to other diamonds (decision nodes) or rectangles that represent final groups and which contain group statistics.

In the PSRO RUGs, the entire dataset is divided into three branches based on the variable DRESS. The first branch, indicating patients who dress themselves or dress with supervision becomes final Group 1, the least resource-intense group, and is split no further. The second branch, indicating those who dress with support, is partitioned into RUGs #2 and #3. RUG #2 contains patients who ambulate by themselves or with supervision, while group #3 consists of patients who need assistance in ambulation.

The third branch, those who are completely dependent upon others to dress, is itself divided into three branches. The first branch, consisting of those who feed themselves or eat with supervision, is divided into final RUGs #4, #5, or #6 according to a patient's ability to ambulate. Group #4 ambulates independently or with supervision, group 5 ambulates with support, while group #6 ambulates only with assistance. The second branch becomes RUG #7, those patients who need support for eating. The third and final branch, those needing total care when fed, is partitioned into final RUGs #8 and #9 according to whether or not fluid intake or output information is collected.

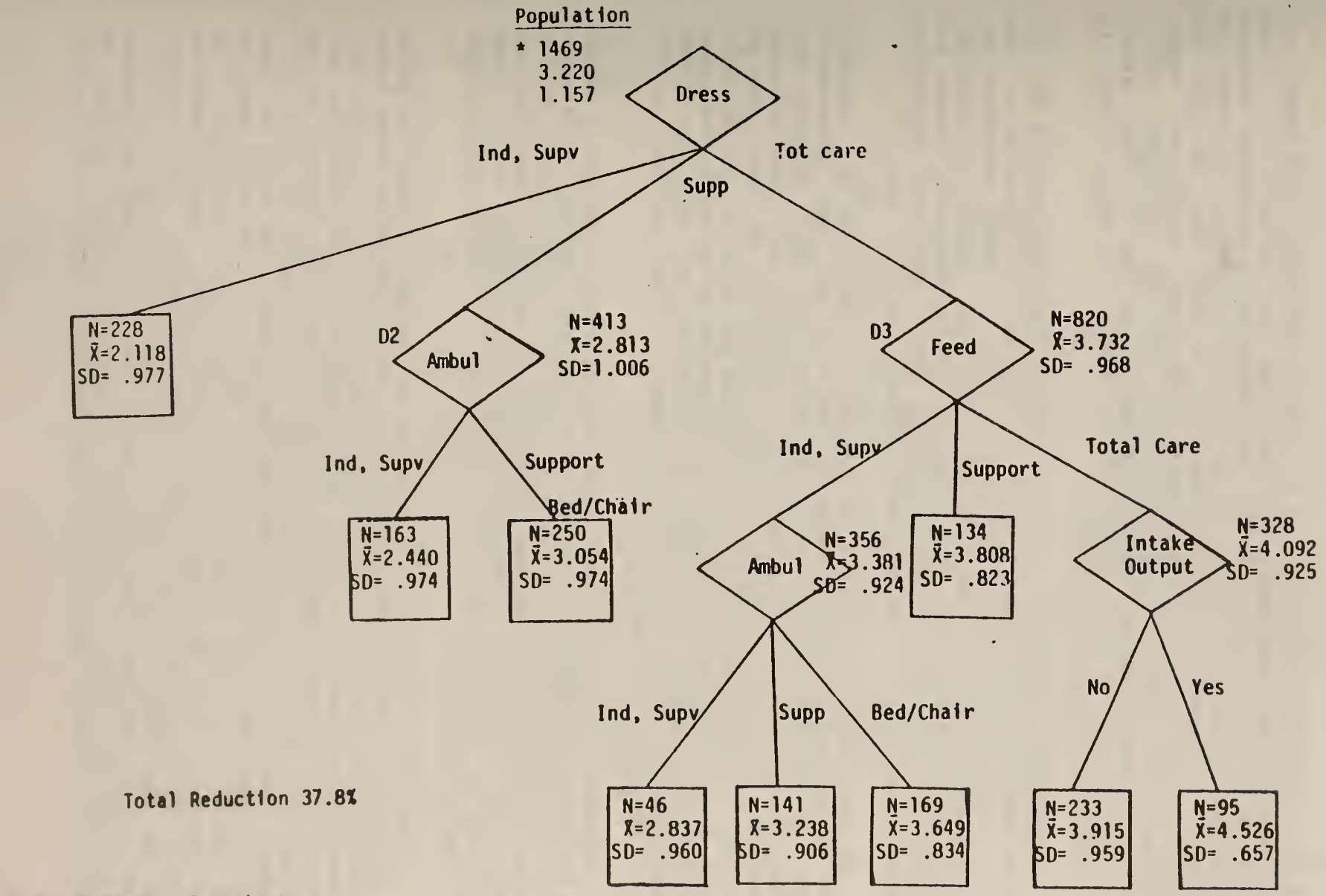
When the sample is split into these nine groups, a total variance reduction of 37.8% is achieved. It should be noted that at each split, missing data may lead to a few patients that are not classified, so that the numbers of patients in the final groups do not exactly total to the initial sample size.

Exhibit 4-6

Variables Used to Define PSRO
Resource Utilization Groups

Variable	Values	Interpretation
DRESS*		Ability to dress oneself
	Ind.	Individually, without aid
	Supv.	With supervision
	Supp.	With staff support
	Tot. care	Only by others
FEED*		Ability to feed oneself
	(see DRESS)	
AMBUL*		Ability to walk
	Ind.	Individually, without aid
	Supv.	With supervision
	Supp.	With staff support
	Bed/chair	Confined to bed or chair
INTAKE/OUTPUT	Yes/no	Monitored for intake/output of fluid
Additional Variables Used in Other or Extended Classification Systems		
AMBUL*		Ability to bathe oneself
	(see DRESS)	
TOILET*		Ability to toilet oneself
	(see DRESS)	
BOWEL		Bowel continence
	Cont.	Continent
	Incont.	Incontinent
BLADDER		Bladder continence
	(see BOWEL)	
NO. MEDICATIONS		Numer of medications prescribed
	0-2	Zero to two medications
	>2	More than two medications
REASON FOR PLACEMENT		Reason for placement in nursing nome
	Temp.-Hip Fx	Temporary - hip fracture
	Temp.-Other Fx	Temporary - other fracture
	Temp.-CVA	Temporary - cardio-vascular accident
	Temp.-Recup.	Temporary - for recuperation
	Perm.-Cognit.	Permanent - cognitive disability
	Perm.-Phy. Dis.	Permanent - physical disability
	Perm.-Sev. Med.	Permanent - severity of medical illness
	Perm.-Term. Care	Permanent - terminal care

*Activity of Daily Living (ADL)



Total Reduction 37.8%

Code: N=number of patients
X̄=mean classification
SD=standard deviation of classification

Exhibit 4-7
The PSRO Resource Utilization Groups

Two of the three variables used to describe functional status (DRESS and FEED) are from those suggested by Katz and others (see Section 2.2). It is not surprising to find that these variables are effective in describing resource consumption, and that our results are parallel and confirmatory of those of others.[55-56] However, it also is interesting to note that the five ADL variables and other variables describing functional status are highly intercorrelated. Although each, individually, has high explanatory power, their joint power is not much greater than only one or two of them, alone. For example, the variable describing the ability to dress, alone, is sufficient to define one of the RUGs.

For reasons discussed in a later section, but mainly pertaining to the ease by which it could be controlled by a facility, the inclusion of the yes-no variable denoted whether or not a patient was being monitored for intake-output of fluids may not always be appropriate. Exhibit 4-8 describes an alternative for this last split, using the next best variable: reason for placement (see definition of values in Exhibit 4-6). With this alternative variable the reduction of variance would decrease from 38% to about 37%.

In developing our final RUGs, we took care to avoid using any variables which would create groups with number of patients less than approximately forty. We were concerned that such small groups might have extremely high variability and that we might be describing coincidence rather than explaining variation. Nevertheless, understanding these limitation, we found that the next set of "splits," providing a more elaborate and detailed classification system, might be made on the following variables: number of medications taken; independence in bathing, toileting, or ambulation; and bowel or bladder incontinence (see Exhibit 4-9). In total, however, these provided us with only an additional 1.8% reduction in variance.

As mentioned earlier, of particular interest in this study was to examine the usefulness of diagnosis as a predictor of patient resource utilization. First, individual diagnoses were examined for their explanatory power of the average classification of the time spent caring for patients. Given the large number of ICD-9 diagnostic codes observed, it was expected, as we indeed found, that no individual code would prove useful in differentiating groups at any stage of the analysis.

It was likely that variables describing the presence or absence of groups of diagnoses (see definitions in Exhibit 3-7), two additional variables formed by combining one or more neurological classifications, and the variable representing the number (1 to 13) of such diagnostic groups would be more descriptive of resource consumption. The last variable was included on the rationale that it might be representative of the complexity of a patient's illness. Exhibit 4-10 displays the reduction observed for each of these variables when used as the initial grouping variables for the entire sample of 1469 patients. Of the yes/no variables, only those associated with neurological diagnoses demonstrated any explanatory power. These included the variables NEURO, indicating neurological motor dysfunction (1.85% variance reduction) and NEURO12, which includes both neurological dysfunction and dementia (1.32% variance reduction). All other, including the variable representing the number of diagnostic categories, CATCOUNT, provided no reduction in variance. Not only were these variables inferior on the basis of

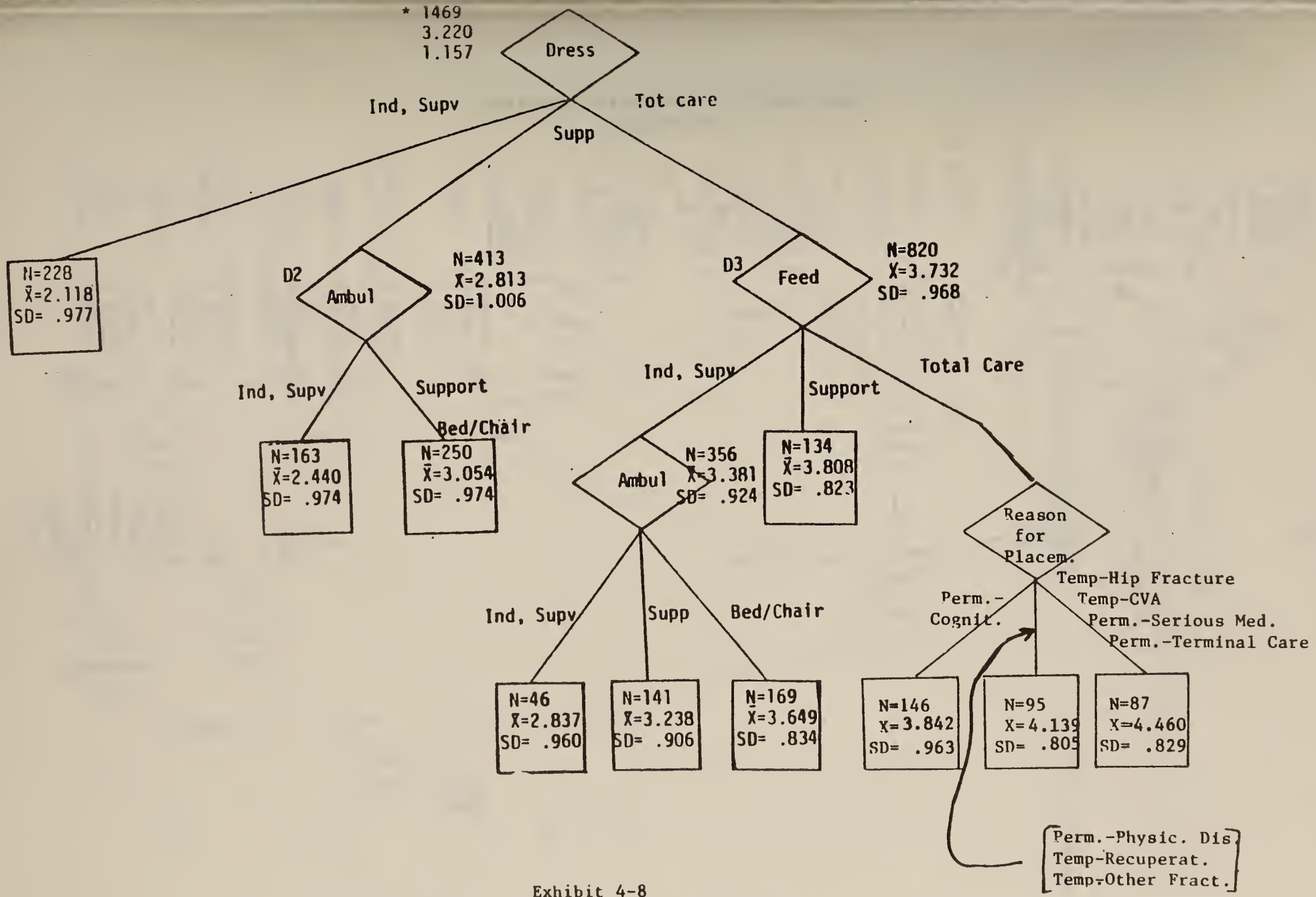
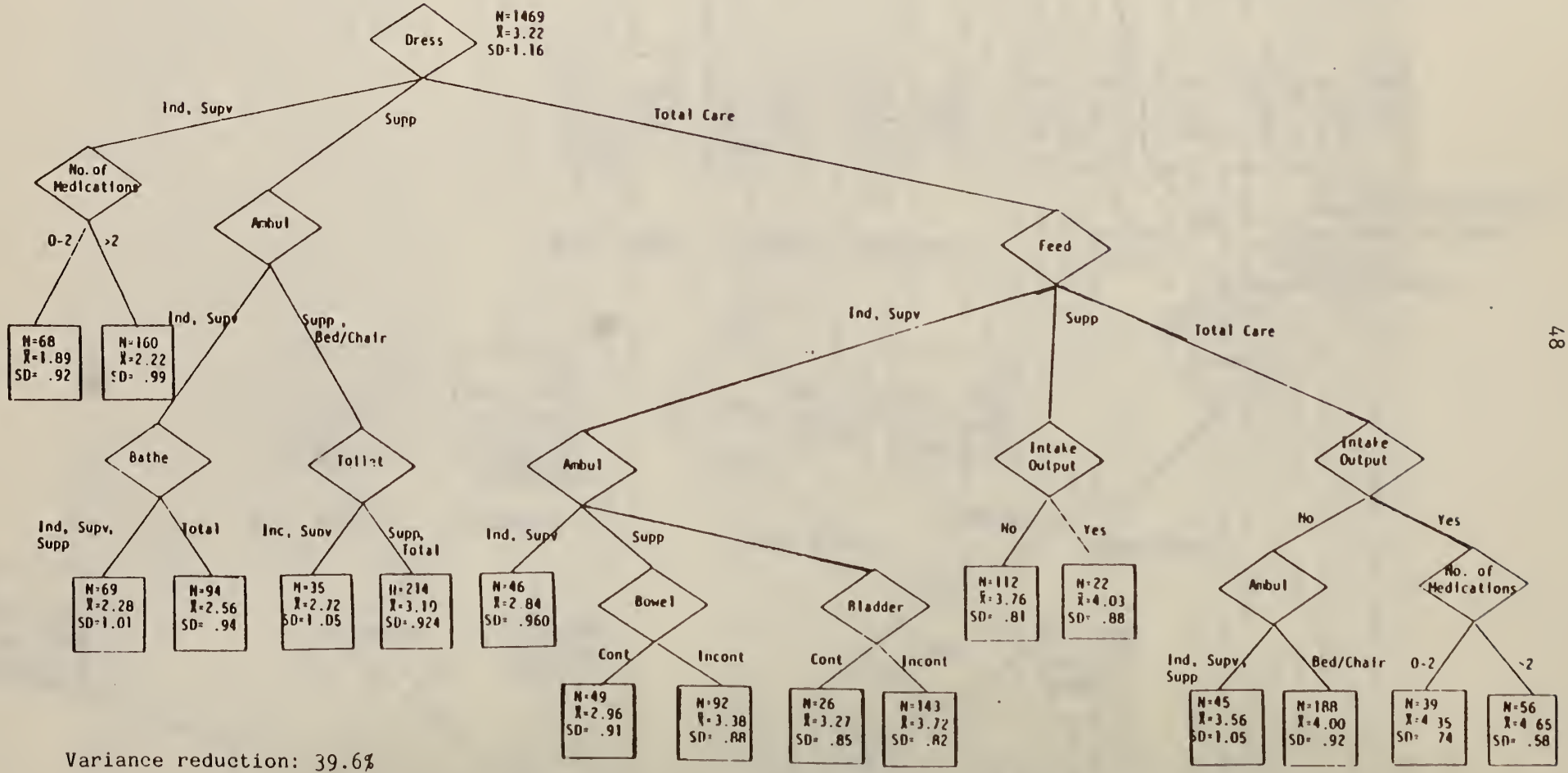


Exhibit 4-8
Using Reason for Placement in PSRO RUGs



Variance reduction: 39.6%

Exhibit 4-9
Possible Further Splits of PSRO RUGs

Exhibit 4-10

Reduction of Variance by Diagnosis Variables
in PSRO Dataset

Variable*	Number of Categories	Percent Reduction
Diagnosis Groups (Yes/No)		
DEMENT	2	0.0
NEURO	2	1.85
PSYCHOS	2	0.0
MUSCSKEL	2	0.0
CARDIAC	2	0.0
PULMON	2	0.0
ENDO	2	0.0
GI	2	0.0
URINARY	2	0.0
PVD	2	0.0
SKIN	2	0.0
EYE	2	0.0
OTHER	2	0.0
Combinations of Neurological Groups		
NEURO12 (DEMENT&NEURO)	2	1.32
NEURO123 (DEMENT&NEURO &PSYCHOS)	2	0.0
Number of diagnostic categories		
CATCOUNT	5	0.0

---

*See Exhibit 3-7 for definitions of variables

reduced variance to other as an initial splitting variable, they also did not provide better full "trees." Analysis of their use at all intermediate and terminal groups (RUGs) showed them to be equally ineffective. In summary, we found these diagnostic groups to provide no explanatory power of the average classification of care needs.

The final PSRO RUGs are defined by only four variables. A number of other patient characteristics have been felt by long-term care experts to be important in determining the resources required for nursing home patients. These characteristics include bladder incontinence, severe confusion, total care with toileting, ability to transfer or to communicate, requiring restraints, and the belligerent/noisy patient. We therefore examined the relative frequency of these characteristics among patients in the nine groups.

The results, displayed in Exhibits 4-11 through 4-15, show that for the most part, these characteristics are well captured in the RUG groups. For example, bladder incontinence showed close to a clear progression from the least intensive RUG through the most intensive one. RUG #1 (least intensive care) included only 1.3% patients who were incontinent of urine while RUGs #8 and #9 (most intensive care) contained 68% and 44% incontinent patients, respectively. Similarly, the percentage of severely confused patients in RUG #1 was 1.8% and the percentages were 55% and 32% in RUGs #8 and #9, respectively. Those patients requiring total care with toilet constituted 1.3% of RUG #1, increasing to 100% of RUG #9. Those patients who were unable to transfer constituted 1.3% of RUG #1 and 96% of RUG #9.

While there was not always perfect progression for all of these characteristics, there is nonetheless a clear relationship between the RUG level and the percentage of patients with the characteristics of "high care needs." This relationship is important. It demonstrates that the RUG system can identify the relative intensity of care required by "high care" patients, as distinguished by the generally accepted characteristics.

The progression through RUG groups of the percentage of patients with restraints was less direct. This percentage peaked in RUG #5 (70.9%) and continued to be high through the remaining four RUGs. This early peak can be anticipated, as restraints are often more necessary for patients with moderate functional deficits than for those whose deficits are severe.

In summary, the four characteristics which formed the nine Resource Utilization Groups acted as excellent surrogates for a number of patient characteristics felt by others to be indicative of intensity of care required for LTC residents.

The results discussed so far all used average (nurse and aide) classification of time as the dependent variable, as our results showed this variable was the most highly correlated with the actual staff times measured in the facilities. We did some preliminary analysis, however, using other dependent variables. Nurse classification as the dependent variable resulted in independent variables with high correlations similar to those seen earlier: the ADL variables for toileting, personal hygiene, feeding, and dressing, as well as transfer, ambulation and continence (Exhibit 4-16). The RUG scheme using nurse classification is displayed in Exhibit 4-17. While the seven groups produced using ability to toilet, bathe, ambulate, and bladder

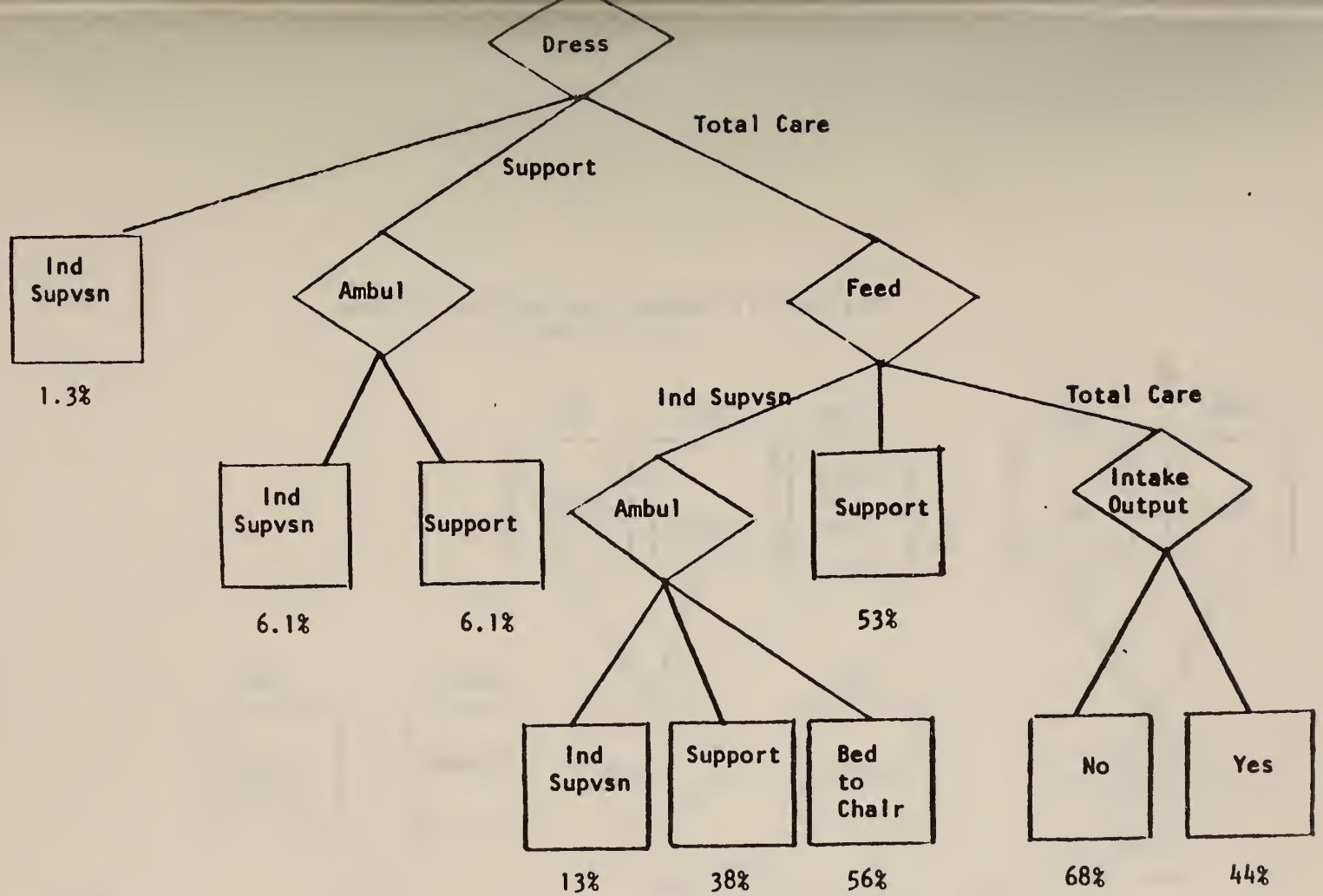


Exhibit 4-11
Tracking Bladder Incontinence in PSRO RUGs

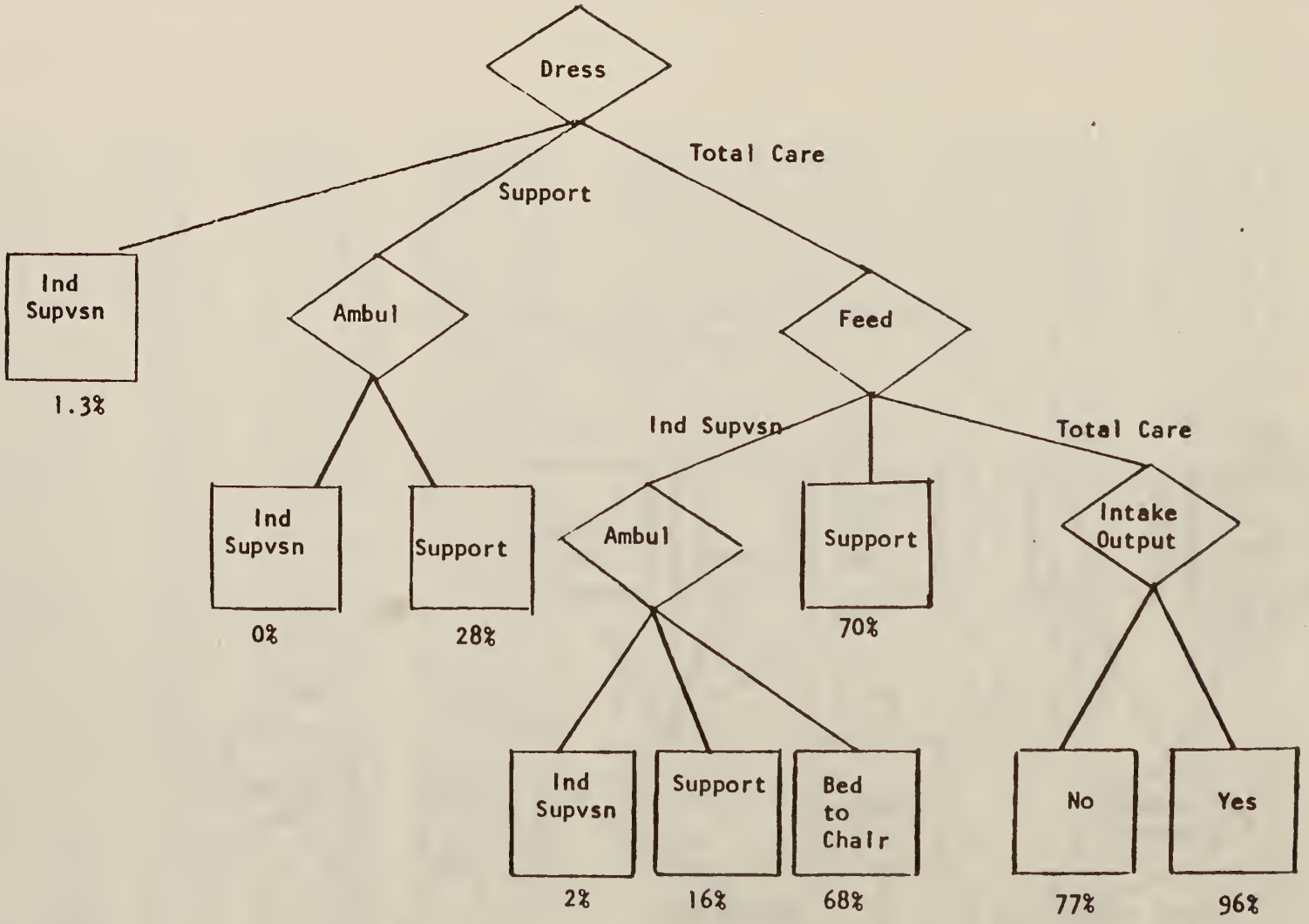


Exhibit 4-12
Tracking Inability to Transfer in PSRO RUGs

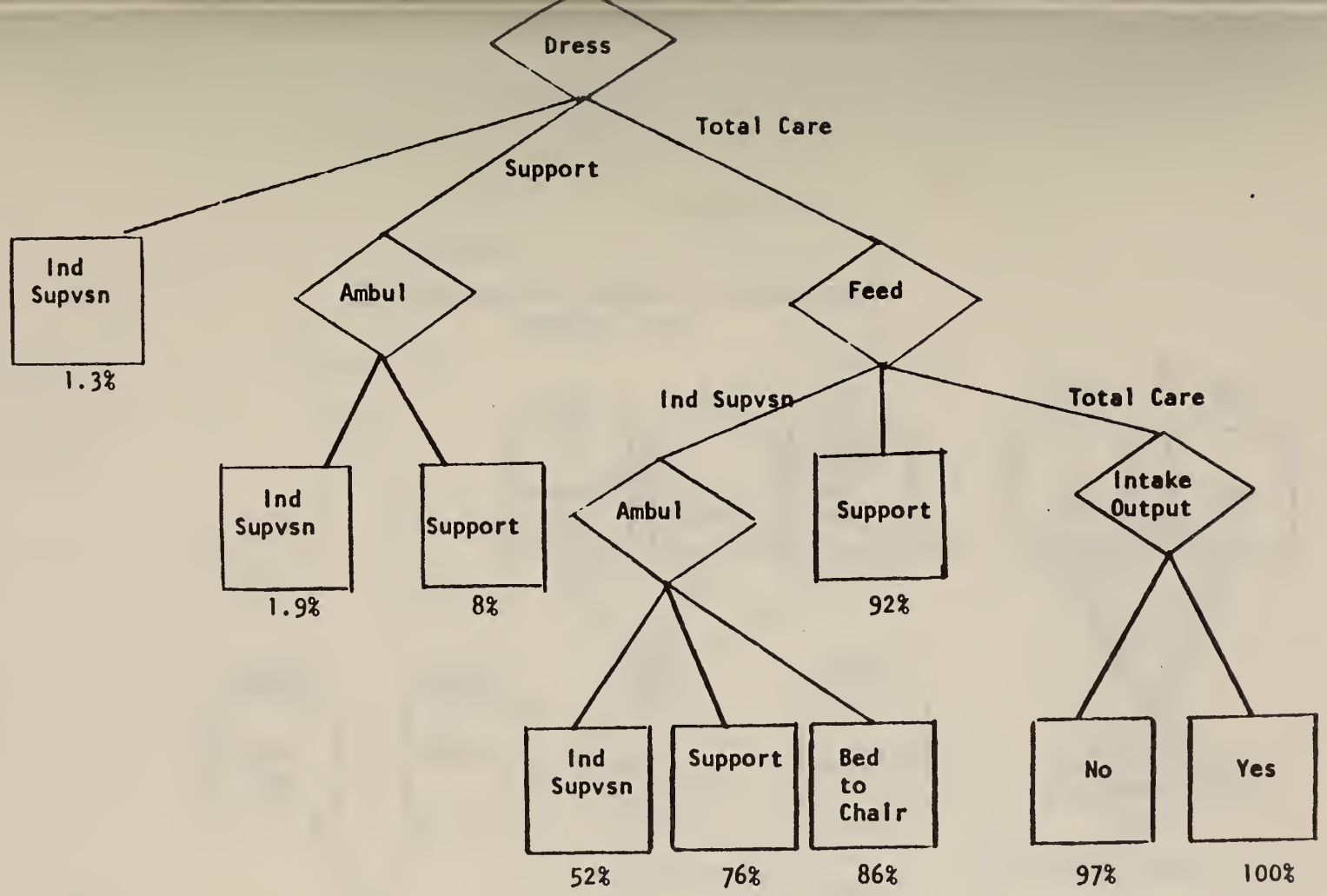


Exhibit 4-13
Tracking Total Care with Toilet in PSRO RUGs

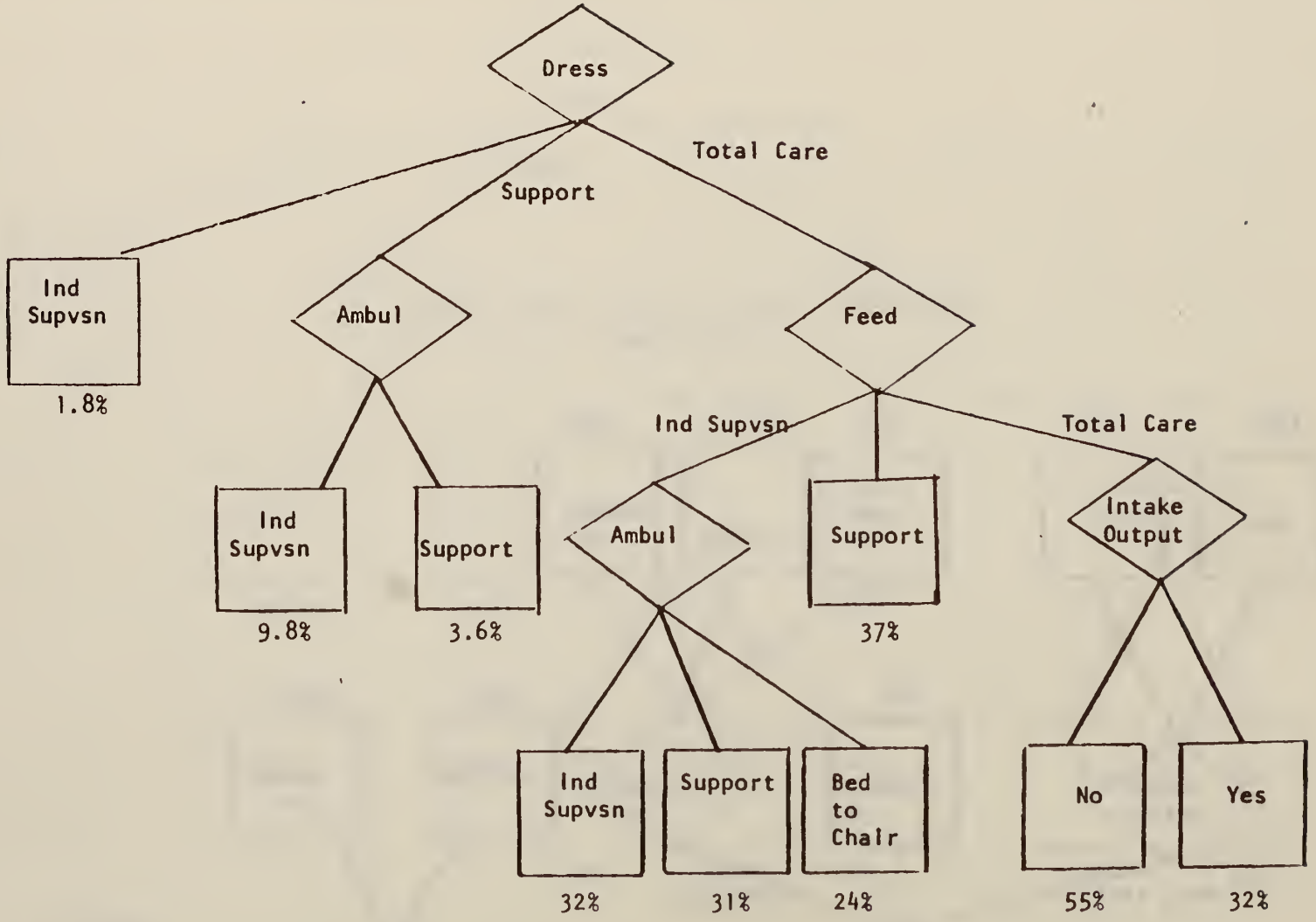


Exhibit 4-14
Tracking Severly Confused in PSRO RUGs

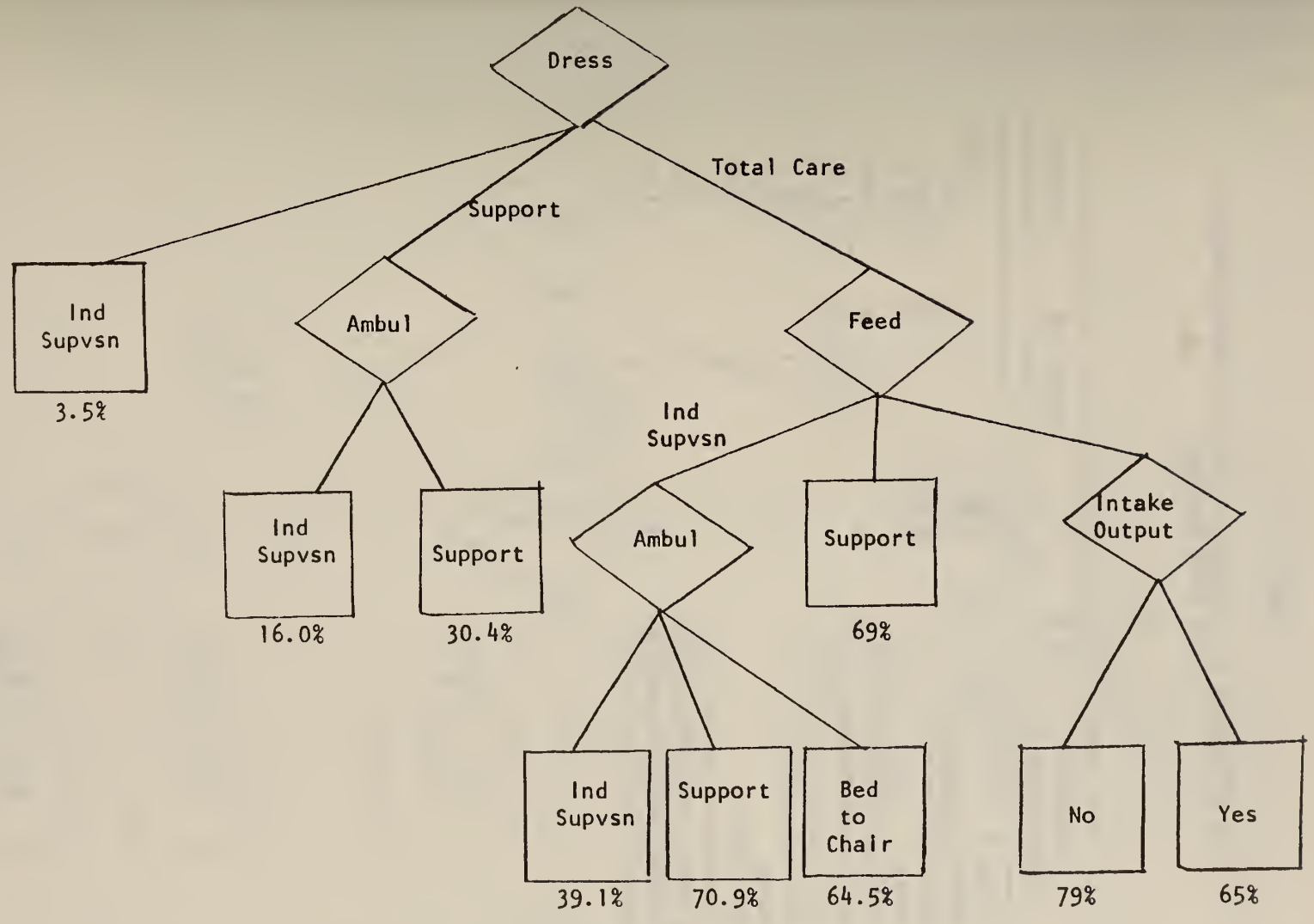


Exhibit 4-15
Tracking Restraints Ordered in PSRO RUGs

Exhibit 4-16

Initial Reduction in Variance of Nurse Classifications
for PSRO Dataset

Variable Name	Variable Description	Number of Groups	Percent Reduction
ATOILT	Toilet	3	27.1%
APERSH	Personal Hygiene	3	26.4
AMBULE	Ambulation	4	26.0
ADRESS	Dress	3	25.9
TRANSF	Transfer Ability	4	24.6
CONTBL	Continence-Bladder	3	21.5
AFEED	Feed	3	20.7
CONTBO	Continence-Bowel	3	17.9
ABATHE	Bathe	2	14.3
RSTRNT	Restraints	2	9.9
PLNACT	Planned Activities	3	8.1
COMEXP	Communication Expressive	2	7.9
COMREC	Communication Receptive	2	7.6
SCSTAF	Sociability	3	6.7

n=1496

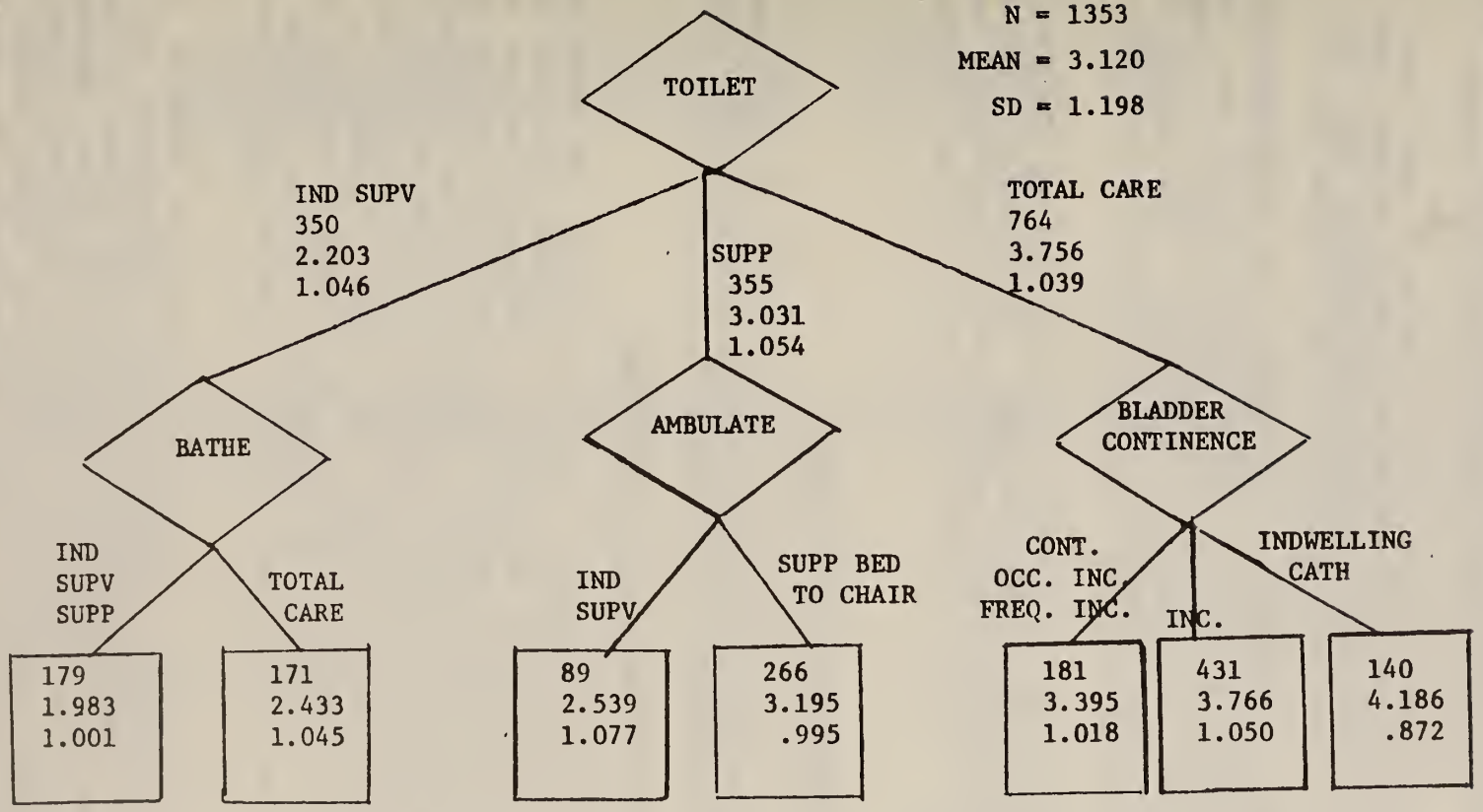


Exhibit 4-17

Resource Utilization Groups for Nursing Classification in PSRO Dataset

continence were statistically sound, they were clinically inappropriate. The three groups under bladder incontinence grouped together patients who were continent, occasionally incontinent and frequently incontinent. This grouping would have to be altered before this grouping scheme could be used.

Using as the dependent variable direct estimates of aide time, neither variables describing the number of medications taken by patients (used in the Battelle studies of nursing time) nor describing diagnosis were seen to be effective. Overall, the variance explained by the model was low.

The major result of this phase of work was the development of nine patient groups which can be used to evaluate the relative care needs of long-term care patients. The patient characteristics used in constructing these groups are easily defined and obtainable. These groups classify patients according to staff estimates of their intensity of care, with group averages ranging from 2.1 to 4.5 on a scale of 1 to 5.

A major concern in the construction of the PSRO RUGs was the strength of the subjectively-determined dependent variable. We therefore examined two other datasets containing objectively measured aide and nurse times, and using these as dependent variables derived two other grouping systems for comparison.

4.3 Two Battelle Resource Utilization Groups

In addition to using cluster analysis on the PSRO II data bases, we evaluated two datasets obtained from the Battelle Institute which accumulated them in their 1974 and 1977 studies, respectively.

4.3.1 1974 Battelle Resource Utilization Groups

Applying the same methodology we used to develop the PSRO Resource Utilization Groups, we developed RUGs using data obtained from the Battelle Institute in their 1974 study of nursing homes. The dataset includes patient characteristics and actual nurse and aide time for a total of 1615 patients in 12 facilities. A total of 192 variables describing patient characteristics were collected, but McCaffree reports that after preliminary analysis, 33 were kept for further analysis, based on their F-ratio or explained to unexplained variance, consistency across facilities, and apriori judgements of their relationship to other retained variables. We obtained from the Battelle Institute data on a total of 30 independent variables covering these characteristics and on the dependent variables of aide and nurse times (see Exhibit 3-5).

Exhibit 4-18 displays the initial explanatory power of each of the 30 possible independent variables, separately for aide (aide/orderly) and nurse time. For aide time, individual reductions of less than 2% were obtained for independent variables describing types or number of medications, whether the patient was verbally or physically abusive, depressed, wandersome, unresponsive, withdrawn, forgetful, or diagnosed with either Chronic Brain Syndrome or diseases of the nervous system. When we examined the explanatory effect of these same variables on nurse time, we found that they similarly had reductions of less than 2%, except for the variable describing whether a

Exhibit 4-18

Initial Variance Reduction for 30 Variables
in Battelle 1974 Dataset

Variable Name*	Aide Time		Nurse Time	
	Variance Reduction**	Number of Groups	Variance Reduction*	Number of Groups
BATH	16.82	3	1.98	2
DRESS	27.99	3	0.0	1
FEED	20.29	3	1.05	2
BLADDER	15.57	3	1.01	2
DEPRESS	0.0	1	0.0	1
DISORIEN	6.13	2	0.0	1
PABUSE	0.0	1	0.0	1
VABUSE	0.0	1	0.0	1
TRANF	28.22	3	0.0	1
WANDER	0.0	1	0.0	1
MEDS	1.35	2	1.44	2
IHMEDS	0.0	1	0.0	1
IRMEDS	0.0	1	0.0	1
ISMEDS	0.0	1	0.0	1
IVMEDS	0.0	1	0.0	1
OMEDS	0.0	1	0.0	1
PMEDS	0.0	1	0.0	1
RMEDS	0.0	1	0.0	1
TMEDS	0.0	1	7.01	2
BOWEL	9.69	2	1.64	2
BBTRAIN	0.0	1	0.0	1
OSTCARE	0.0	1	0.0	1
INCATH	5.25	3	0.0	1
EXTDEV	0.0	1	0.0	1
CBSDX	1.56	2	0.0	1
NERVDX	1.13	2	1.86	2
FORGET	0.0	1	0.0	1
RESTRAIN	7.56	2	0.0	1
UNRESP	1.21	2	0.0	1
WTHDRAWN	0.0	1	0.0	1

*see Exhibit 3-5 for definition of variables
**n=1615

patient was receiving topical medicines, which had a reduction of seven percent. Only five independent variables (functional independence in bathing, dressing, feeding, and transfer, and bladder continence) manifested over a ten percent reduction in variance in aide time, with two more (bowel continence and use of restraints) providing individual reductions of between seven and ten percent.

The initial clustering was performed using aide/orderly time as the dependent variable. We considered all seven variables with over seven percent individual reductions as candidates for initial splits (Exhibit 4-19). The analysis showed that the three variables with the greatest explanatory power, which also were those identified by other researchers as significant predictors of patient resource utilization, would be those most reasonable to define patient groups. The final decision was to use three variables (TRANSFER, DRESS, and FEED) to create seven resource utilization group in the Battelle 1974 RUGs (Exhibit 4-20), and provided total variance reduction of 34%. Using either DRESS or FEED for the initial split provided classification systems with slightly poorer explanatory power (i.e., lower variance reduction) and that were no more reasonable on clinical grounds.

The distribution of aide and nurse times were fairly skewed with a long tail of high values (see Exhibits 4-21 and 4-22). We decided to evaluate separately the major portion of the distribution and the outliers. Ten patients with aide times in excess of 200 minutes and 46 patients with nurse times in excess of 1000 minutes, a total of 56 observations, were considered outliers. Displaying the distribution of each of the independent variables for the outlier population failed to isolate any characteristics common to the group. For example, these "heavy care" patients needed help in feeding themselves, ambulating, dressing and bathing in approximately the same proportions as the entire patient population (see Exhibit 4-23). For only one variable, depression, was there a highly significant difference (at the 1% level) between the outliers and the full dataset. As the result was significant in the direction opposite that expected, we presume that the significant test was spurious.

Removing the outliers and clustering the remaining set of 1559 patients resulted in the same RUG system as for the original (untrimmed) dataset, although the variance reduction achieved rose to 44.53%, an increase of about 10% (see Exhibits 4-24 through 4-26).

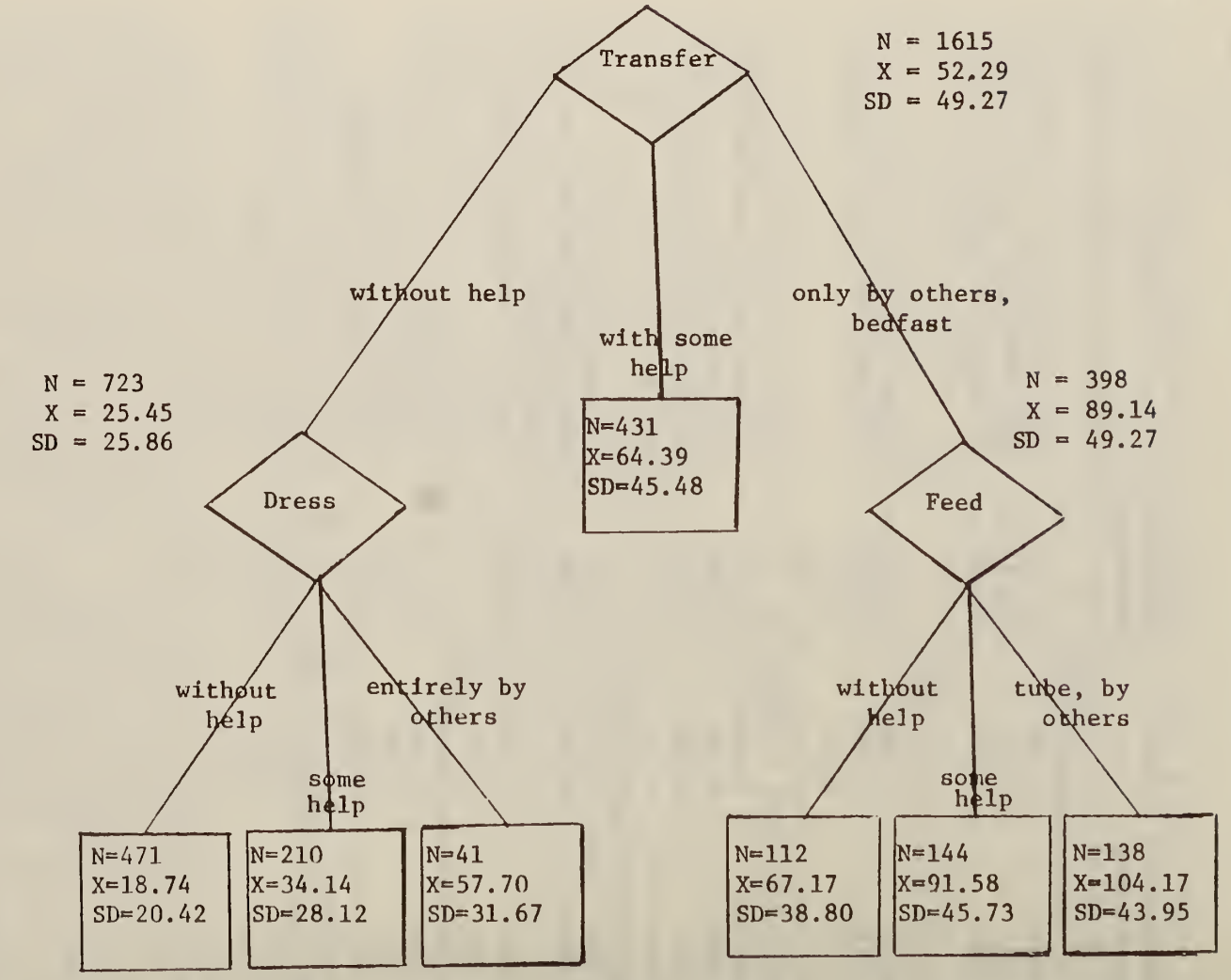
The dominance of ADL-type variables in defining RUGs from both the trimmed and untrimmed 1974 Battelle data lead us to explore the use of other types of variables for the initial split; we chose physical/verbal abuse and disorientation as being reasonable on clinical grounds. However, we found that the functional variables appeared just as important for secondary partitioning, so no additional insight was obtained (see, for example, Exhibit 4-27). Although almost the same or higher reductions in the variance of trimmed aide time were obtained (44.29% and 44.86% for the trees beginning with physical/verbal abuse and with disorientation, respectively) these reductions were achieved with 12 groups, and the grouping systems were deemed inferior to the original system with fewer groups.

The final analysis of the 1974 Battelle data concentrated on nurse times. Exhibit 4-18 presents the independent explanatory power of each of the 30

Exhibit 4-19

Details of Variables with Reduction of 7% or Greater in Aide Time for Battelle 1974 Dataset

Number of Observations	Mean	Standard Deviation	Description
TRANSF (total reduction 28.22%)			
786	26.99	27.94	without help or no code(63)
431	64.39	56.61	with some help
398	89.14	45.54	by others or bedrest
DRESS (total reduction 27.99%)			
523	21.42	23.14	without help
518	47.95	53.98	with some help or no code(57)
574	84.33	42.55	
FEED (total reduction 20.29%)			
1153	38.85	44.12	without help or no code(57)
299	76.86	43.84	with some help
163	102.24	43.76	fed by others or tube(15)
BATH (total reduction 16.82%)			
147	18.98	26.97	without help
842	40.04	47.99	with supervision,help or no code(65)
626	76.59	44.16	bathed entirely by others
BLADDER (total reduction 15.57%)			
994	37.46	45.05	no problem
127	59.80	58.36	retention or no code (117)
494	80.19	41.91	involuntary loss or other
RESTRAIN (total reduction 7.56%)			
1289	45.47	48.22	no
326	79.24	44.03	yes or no code (2)



Total Reduction: 34%

Exhibit 4-20
Battelle 1974 Resource Utilization Groups
(Aide Time Dependent)

Exhibit 4-21

Distribution of Aide Time: Battelle 1974 Dataset

Range (minutes)	Number of Observations	Percentage
0-9	259	16.0%
10-19	223	13.8
20-29	156	9.7
30-39	138	8.5
40-49	134	8.3
50-59	110	6.8
60-69	111	6.9
70-79	90	5.6
80-89	85	5.3
90-99	75	4.6
100-109	57	3.5
110-119	56	3.5
120-129	33	2.0
130-139	24	1.5
140-149	23	1.4
150-159	9	0.6
160-169	10	0.6
170-179	7	0.4
180-189	2	0.1
190-199	3	0.2
200-209	3	0.2
210-219	0	0.0
220-229	2	0.1
230-239	1	0.1
240-249	0	0.0
250-259	1	
• — •		
340-349	1	0.1
350-349	1	0.1
— •		
960-969	1	0.1

---

n=1615

Exhibit 4-22

Distribution of Nurse Time: Battelle 1974 Dataset

Range (minutes)	Number of Observations	Percentage
0-24	987	61.1%
25-49	267	16.5
50-74	60	3.7
75-99	14	0.9
100-144	6	0.4
150-199	9	0.6
200-244	10	0.6
250-299	9	0.6
300-344	9	0.6
350-399	12	0.7
400-444	13	0.8
450-499	15	0.9
500-544	10	0.6
550-599	13	0.8
600-644	21	1.3
650-699	11	0.7
700-744	16	1.0
750-799	28	1.7
800-844	21	1.3
850-899	14	0.9
900-944	17	1.1
950-999	7	0.4
1000-1049	6	0.4
1050-1099	7	0.4
1100-1149	6	0.4
1150-1199	3	0.2
1200-1249	4	0.2
1250-1299	2	0.1
1300-1349	5	0.3
1350-1399	2	0.1
1400-1449	5	0.3
1450-1499	2	0.1
1550-1599	1	0.1

n=1615

Exhibit 4-23

Examination of Outliers: Battelle 1974 Database

	All Patients (n=1615)	Outliers (n=56)
Bathed by others	40.4%	39.3%
Dressed by others	36.9	35.7
Feed by others or tube	10.5	19.6*
Transfer by others or bedbound	25.6	30.4
Bowel/Bladder training	2.2	5.4
CBS Diagnosis	21.9	10.7*
Catheter	7.6	10.6
Unresponsive	5.2	3.6
Disoriented	25.8	12.5*
Restrained	20.1	16.1
Wandersome	8.1	1.8
Verbally abusive	12.5	14.3
Physically abusive	5.7	7.1
Forgetful	33.1	25.0
Depressed	19.8	35.7**
Withdrawn	17.8	16.1

---

* Significant difference at 5% level
**Significant difference at 1% level

Exhibit 4-24

Initial Variance Reduction for 30 Variables
in Trimmed Battelle 1974 Dataset

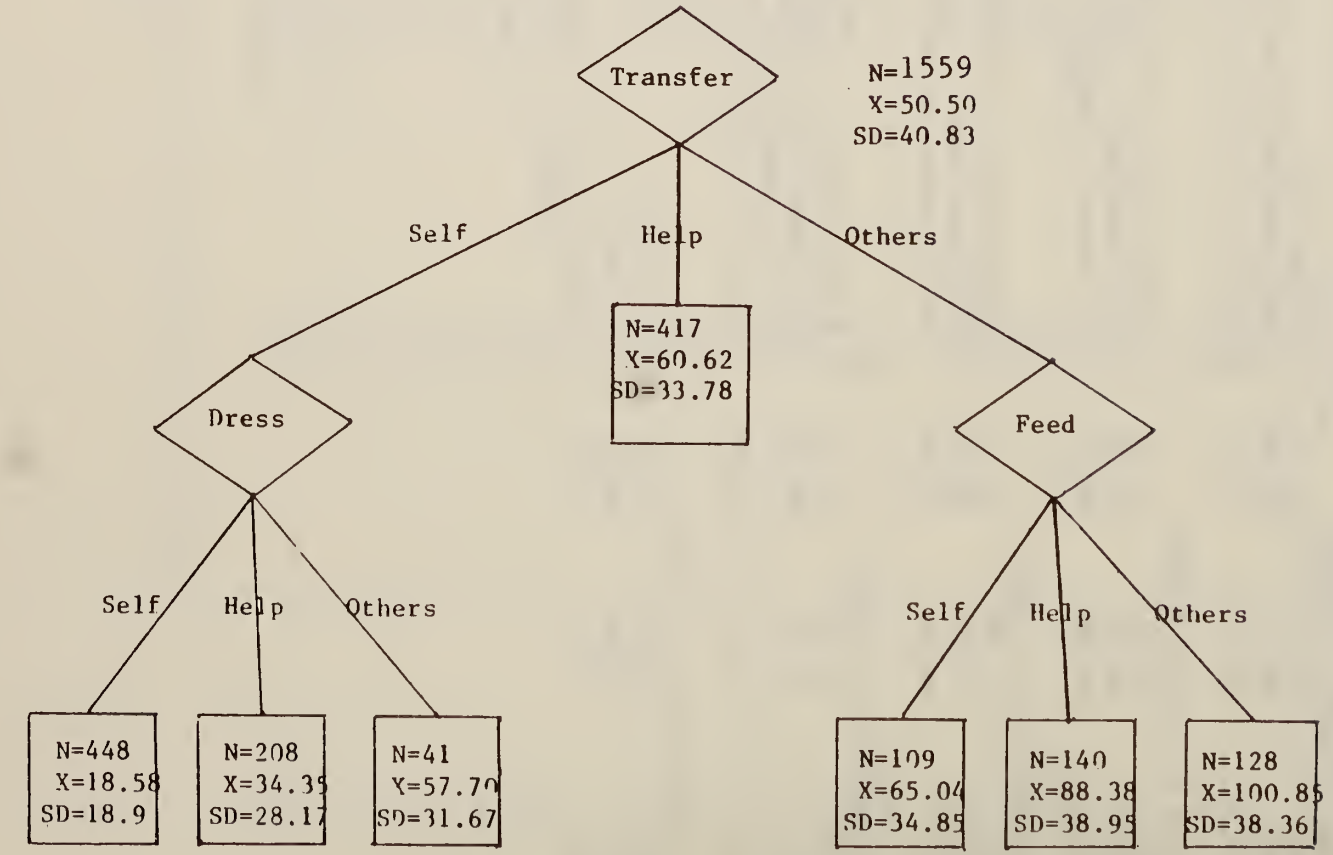
Variable Name*	Aide Time		Nurse Time	
	Variance Reduction**	Number of Groups	Variance Reduction*	Number of Groups
BATH	23.29	3	3.67	2
DRESS	37.81	3	0.0	1
FEED	27.94	3	0.0	1
BLADDER	21.31	3	1.12	2
DEPRESS	0.0	1	0.0	1
DISORIEN	9.80	2	0.0	1
PABUSE	0.0	1	0.0	1
VABUSE	0.0	1	0.0	1
TRANF	36.03	3	0.0	1
WANDER	0.0	1	0.0	1
MEDS	1.64	2	1.21	2
IHMEDS	0.0	1	0.0	1
IRMEDS	0.0	1	0.0	1
ISMEDS	0.0	1	0.0	1
IVMEDS	0.0	1	0.0	1
OMEDS	0.0	1	0.0	1
PMEDS	0.0	1	0.0	1
RMEDS	0.0	1	0.0	1
TMEDS	1.01	2	5.11	2
BOWEL	13.62	2	1.88	2
BBTRAIN	0.0	1	0.0	1
OSTCARE	0.0	1	0.0	1
INCATH	4.16	2	0.0	1
EXTDEV	0.0	1	0.0	1
CBSDX	1.94	2	0.0	1
NERVDX	1.39	2	1.72	2
FORGET	0.0	1	0.0	1
RESTRAIN	10.62	2	0.0	1
UNRESP	2.19	2	0.0	1
WTHDRAWN	0.0	1	0.0	1

*see Exhibit 3-5 for definitions of variables
**n=1615

Exhibit 4-25

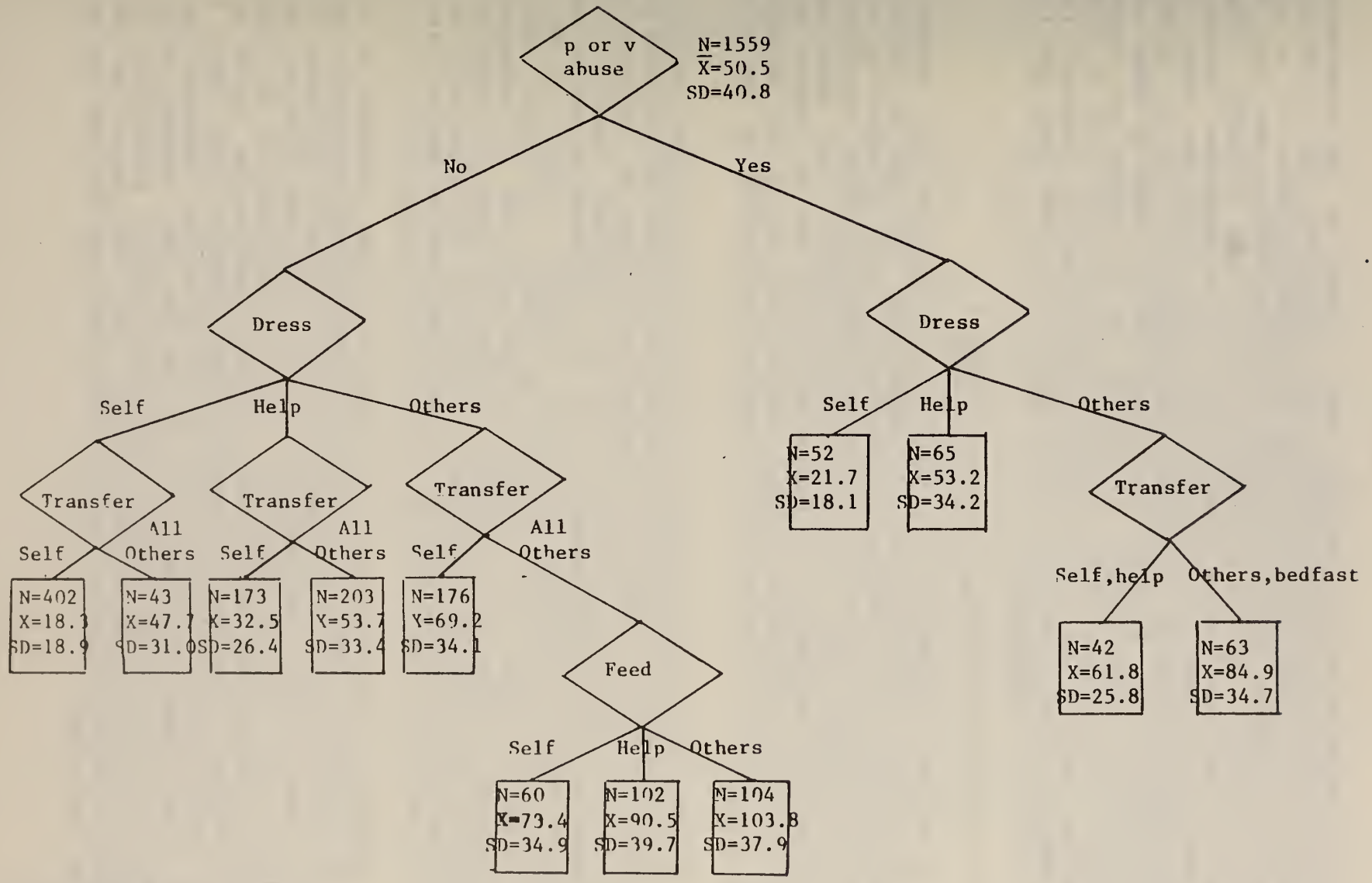
Details of Variables with Reduction of 20% or Greater
in Trimmed Aide Time for Battelle 1974 Dataset

Number of Observations	Mean	Standard Deviation	Description
DRESS (total reduction 37.81%)			
500	21.39	22.09	without help
505	44.95	33.49	with some help or no code(59)
554	81.83	38.21	entirely by others
TRANSF (total reduction 36.03%)			
761	27.18	27.52	without help or no code(63)
417	60.62	33.82	with some help
381	85.99	40.10	by others or bedrest
FEED (total reduction 27.94%)			
1057	37.40	32.53	without help or no code(57)
293	75.22	40.11	with some help
152	98.88	38.65	fed by others or tube(15)
BATH (total reduction 23.29%)			
144	17.74	22.37	without help
811	38.70	34.43	with supervision, help or no code(65)
604	74.15	39.95	entirely by others
BLADDER (total reduction 21.31%)			
963	36.43	33.43	no problem
110	53.00	43.72	no code
486	77.81	39.63	involuntary loss, retention, or other



Total Reduction = 44.53%

Exhibit 4-26
Resource Utilization Groups for Trimmed Battelle
1974 Dataset (Aide Time Dependent)



Total reduction: 44.20%

Exhibit 4-27
Resource Utilization Groups for Trimmed Battelle
1974 Dataset (Aide Time Dependent) Using
Physical/Verbal Abuse as Initial Split

variables available from the Battelle data. Except for the dichotomous (yes-no) variable describing the use of topical medications with a variance reduction of 7%, no variable had more than 2% explained variance. It is not surprising, therefore, that no classification system enabled more than 8% variance reduction. The best classification system using (trimmed) nursing time as the dependent variable is based in part on an independent variable, comparable to that used by the Battelle group, which counts the number of dependencies of the patient. We produced this variable as shown in Exhibit 4-28. (Actually, the Battelle study results use a weighted number of dependencies, but these weights are useless in the context of cluster analysis.) This system, shown in Exhibit 4-29, achieved only an 8.4% reduction of nursing time variance for the trimmed dataset, in contrast to the 44% reduction in aide time variance achieved with the seven groups of the final 1974 Battelle RUG system.

4.3.2 1977 Battelle Resource Utilization Groups

We similarly analysed the 1977 Battelle data, a sample of 1231 patients collected from a stratified group of 16 nursing homes. The data on patient characteristics in this study came from two sources: data collected by the study team and that collected by the facilities themselves in the Comparative Health Data Program (CHDP). The Battelle Institute reported that there was little difference between the variables of each source, and we limited our analysis to the 29 independent variables collected directly by the Battelle team. The variables are essentially the same as those recorded in the 1974 Battelle study.

Results obtained from the analysis of the 1977 data were almost identical to those obtained for the 1974 data, a finding totally compatible with that of the Battelle Institute. Exhibit 4-30 displays the reduction of variance in both aide and nurse time achieved by the 29 independent variables. A comparison with Exhibit 4-18 demonstrates that few differences are see in the explanatory power of variables in the two datasets. Perhaps the only significant difference is in the capability of variables to predict nurse time: in the 1977 data, five variables provide more than 5% reductions (independence in feeding and in transfer, in-dwelling catheter, number of medications, and irrigation medications) whereas in the 1974 dataset only one, topical medications, achieved that level. We discuss first our analysis using aide time as the independent variable, then that using nursing time.

With high explained variance of aide time for the same variables as in the 1974 dataset (see Exhibit 4-31) it is not surprising that the results for the 1977 data were virtually coincident. We first used the B74 RUG system to classify these patients. The seven groups created explained 52.0% of the variation in aide time (see Exhibit 4-32). With the 1974 data, the B74 RUGs were able to achieve only 34% reduction. The best classification system we derived achieved a total variance reduction slightly greater, 54.2%, using a total of eight groups: the presence of restraints was used to dicotomize the middle group ("transfer with some help") in the B74 RUGs (Exhibit 4-33). Although this system did not provided significantly superior performance, we nevertheless retained it as the best for the 1977 data. Except for the splitting of the middle group, those who transfer only with some help, the two systems are the same.

Exhibit 4-28

Definition of the Variable "Number of Dependencies"

Variable counts the number of the following conditions that pertain:

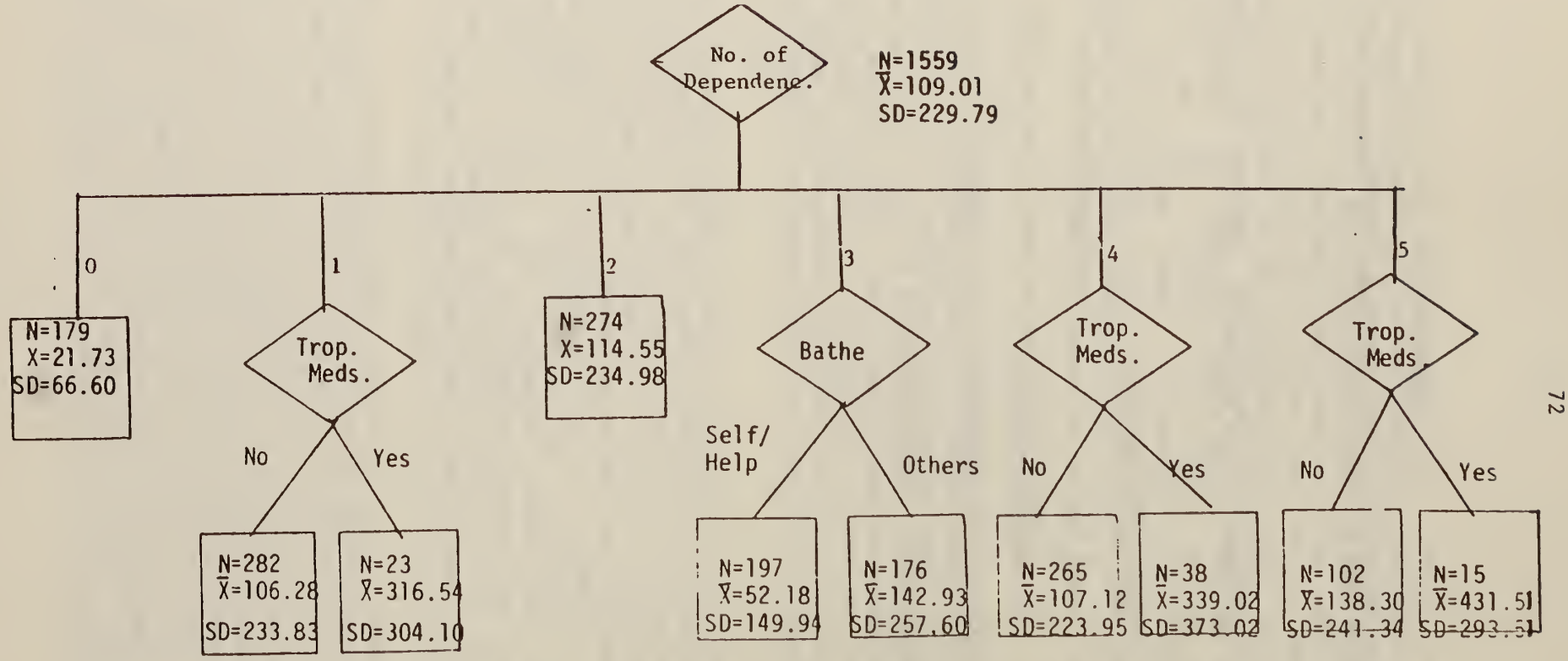
Feeding - by spoon or by tube

Transfer - with help or by others, or bedfast

Dress - with help or by others

Bath - with help or supervision, or by others

Bladder or Bowel - involuntary loss



Total Reduction = 8.42%

Exhibit 4-29
Resource Utilization Groups for Battelle 1974 Dataset (Nurse Time Dependent) Using Number of Dependencies as Initial Split

Exhibit 4-30

Initial Variance Reduction for 29 Variables
in Battelle 1977 Dataset

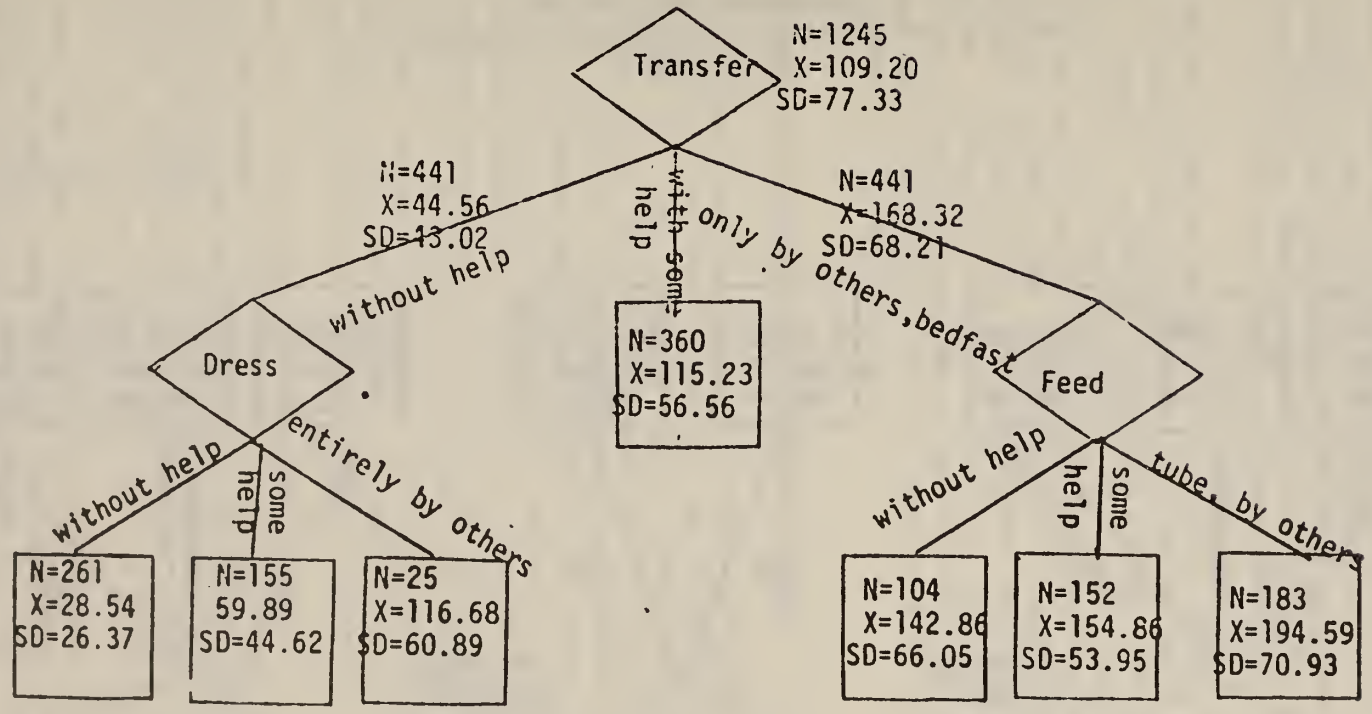
Variable Name*	Aide Time		Nurse Time	
	Variance Reduction**	Number of Groups	Variance Reduction*	Number of Groups
BATH	32.52	3	1.49	2
DRESS	45.91	3	2.61	2
FEED	34.43	3	10.47	3
TOILET	37.03	3	3.55	3
TTREQ***	35.21	3	3.06	2
DEPRESS	0.00	1	0.0	1
DISORIEN	7.26	2	0.0	1
PABUSE	0.0	1	0.0	1
VABUSE	0.0	1	0.0	1
TRANF	45.90	3	9.51	3
WANDER	0.0	1	0.0	1
MEDS	1.64	2	6.75	3
IHMEDS	0.0	1	0.0	1
IRMEDS	0.0	1	7.42	2
ISMEDS	0.0	1	0.0	1
IVMEDS	0.0	1	0.0	1
PMEDS	0.0	1	2.90	2
RMEDS	2.33	2	0.0	1
TMEDS	1.95	2	1.32	2
BBTRAIN	0.0	1	0.0	1
OSTCARE	0.0	1	1.82	2
INCATH	4.19	2	5.37	2
EXTDEV	0.0	1	2.48	2
CBSDX	0.0	1	0.0	1
NERVDX	0.0	1	0.0	1
FORGET	0.0	1	0.0	1
RESTRAIN	23.01	3	0.0	1
UNRESP	2.76	2	0.0	1
WTHDRAWN	0.0	1	0.0	1

*see Exhibit 3-5 for definition of variable names (also see ***)
**n= 1245
***yes-no variables for "toilet training required"

Exhibit 4-31

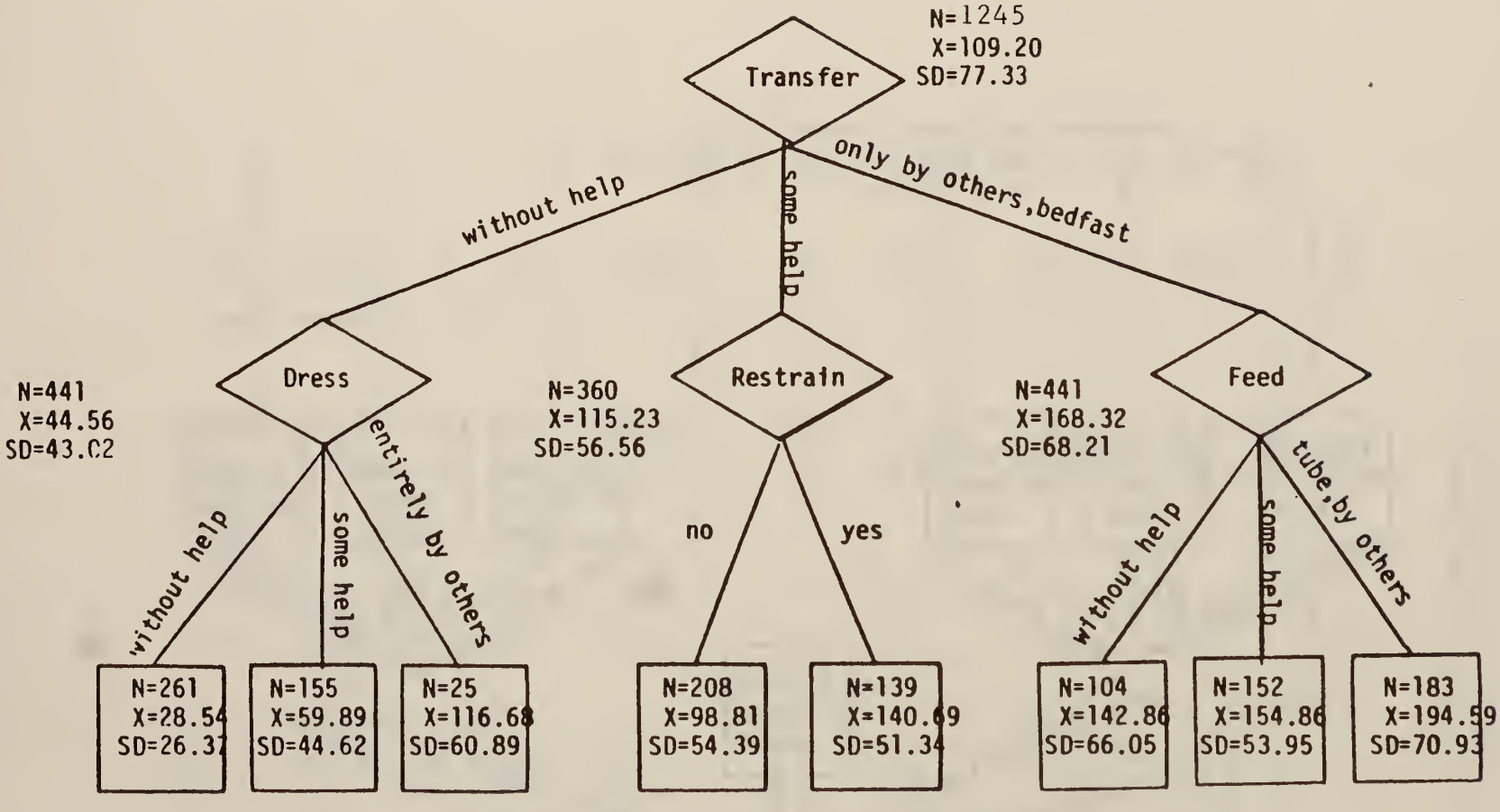
Details of Variables with Reduction of 20% or Greater in Aide Time for Battelle 1977 Dataset

Number of Observations	Mean	Standard Deviation	Description
DRESS (total reduction 45.91%)			
280	31.81	31.17	without help
379	86.81	54.78	with some help
586	160.65	66.93	entirely by others, no code(2)
TRANSF (total reduction 45.90%)			
441	44.65	43.07	without help
360	115.23	56.64	with some help
444	168.50	68.18	by others, bedrest, or no code(3)
TOILET (total reduction 37.03%)			
461	54.19	51.56	complete self care
337	111.26	65.67	needs help, wetting, no bowel control, no bladder control
447	164.36	67.23	wetting & soiling, soiling, no bladder or bowel control, no code(15)
TTREQ (total reduction 35.21%)			
545	58.83	53.20	no training
287	130.17	64.37	patient training, no code(5)
413	161.09	71.37	family training
FEED (total reduction 34.43%)			
728	73.83	61.41	without help
325	138.42	60.63	with some help, by tube, no code(3)
192	193.82	70.48	fed by others
BATH (total reduction 32.52%)			
256	46.20	42.60	without help, with supervision
384	82.84	61.85	with help, no code(5)
605	152.58	71.58	entirely by others
RESTRAIN (total reduction 23.01%)			
807	81.87	69.71	restraints no required
438	159.55	64.44	requires restraints, no code(45)



Total Reduction: 52%

Exhibit 4-32
Utilizing the Battelle 1974 RUGs for the Battelle
1977 Dataset (Aide Time Dependent)



Total reduction: 53.8%

Exhibit 4-33
The Battelle 1977 Resource Utilization Groups
(Aide Time Dependent)

Similar to the procedure with the 1974 Battelle dataset, we identified patients that were outliers on the distribution of aide and nurse time, and evaluated these cases for patterns that might explain why they were different. Twenty-two patients with aide times in excess of 300 minutes and seventeen patients with nurse times in excess of 150 minutes were trimmed, a total of 43 outliers out of the full sample of 1245 patients. In contrast with the 1974 data, however, these patients were highly dependent for activities of daily living and significantly different than the rest of the patient population. Over 81% needed to be transferred by other or were bed-bound, 91% were dressed or bathed entirely by others, and 65% were feed by others. We thus felt comfortable analysing the dataset as a whole without excluding outliers.

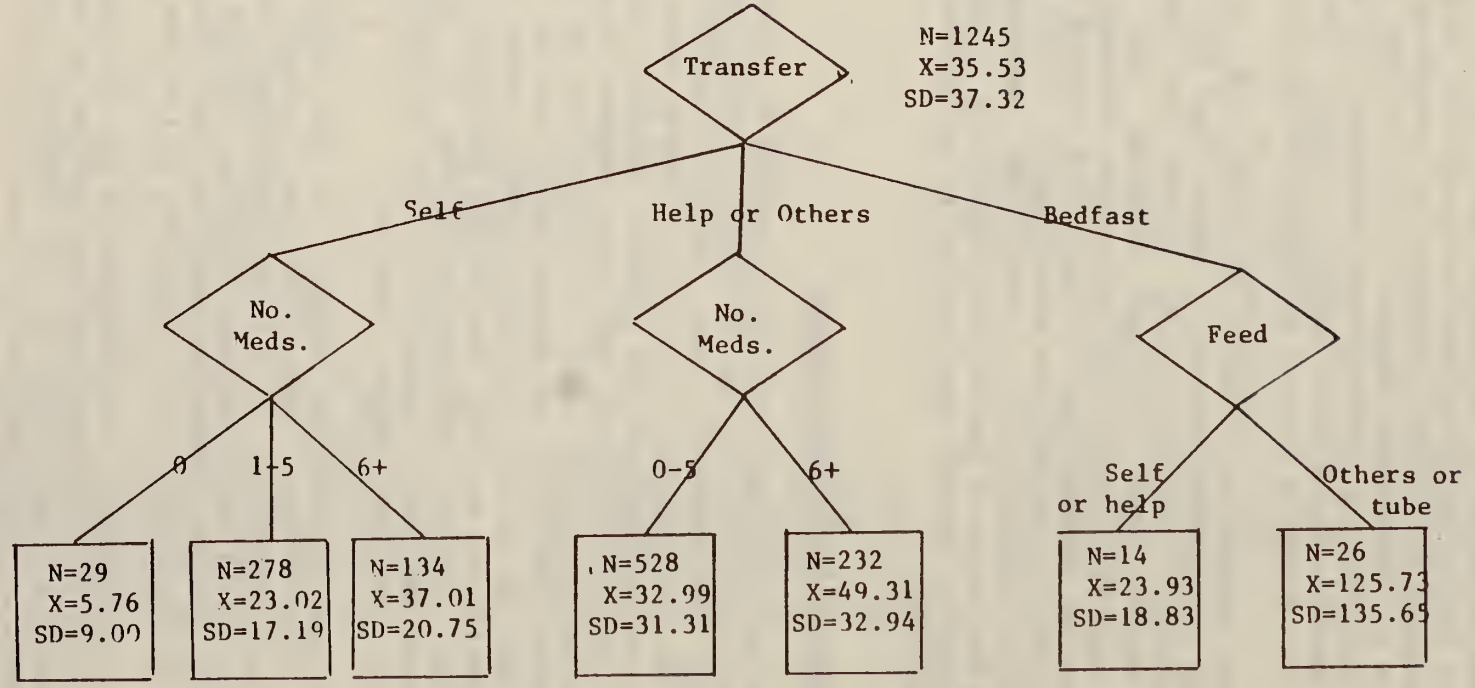
The major difference between the results for 1974 and 1977 Battelle datasets was the greater explanation achieved of nurse time. With the higher explained variance achieved independently by several of the patient characteristics (see Exhibit 4-30) it was expected that a viable classification system could be produced. The best system, displayed in Exhibit 4-34, used the variables for independence of transfer and feeding, and number of medications. It achieved a total variance reduction of 19.2% with seven final groups. We found, as did the Battelle group, the importance of the variable which counted the number of medications; that this occured is not surprising, since considerable nursing time is required for patients receiving a large number of medications.

4.4 Comparison of Patient Classification Systems

The previous section describes the development of three patient classification systems — the PSRO, B74 and B77 RUGs — which were derived from the PSRO II, the 1974 Battelle, and the 1977 Battelle datasets, respectively. Given the differences in how and where these data were collected, it would not be surprising if the derived patient classification systems were different. On the other hand, the same patient characteristics predicted initial variation in the resource consumption as defined by subjective staff estimates (PSRO data) and measured aide time (Battelle data). These characteristics were the ability to bathe, dress, feed, and toilet oneself, ability to transfer and ambulate, and bladder continence. Moreover, several of the variables used to differentiate groups in the different classification systems are the same. In addition, we have already noted that the B74 and B77 RUGs are structurally almost identical.

These similarities give considerable support to the validity of the subjective estimates used in the PSRO study, and suggest that the classification systems are concordant. We set out to show that they are all in fact only different in form, not in content. That is, although the systems have different number of groups, variables used and the order of their application, etc., in use they would classify patients in the same manner.

We have been able to demonstrate this commonality in two manners. The first, described here, uses the Klastorin technique detailed in Section 3.5. The second was performed at a later stage of the analysis, comparing how facilities' case-mix would be ranked based on the three different systems. We describe these latter results in the next section.



Total Reduction: 19%

Exhibit 4-34
Resource Utilization Groups for the Battelle 1977
Dataset (Nurse Time Dependent)

The Klastorin technique applied here evaluates the equivalence of each pair of classification systems when applied to each of the three data bases. Each individual test is performed by examining all possible pairs of patients in the sample and determining whether the pair is consistently placed in the same or in different patient groups by the two classification systems.

The proportion of agreement is high between schemes across all three data bases, and ranges from .88 (PSRO vs. B74 on the PSRO data base) to .97 (B74 vs B77 on the Battelle 1974 data base), where 1.00 would represent perfect agreement (see Exhibit 4-35). The z-statistics for all comparisons exceeded 200, indicating that the index of agreement is statistically significant ($p<.0001$) and that the differences between the three systems cannot be distinguished. This result is strengthened by its replication across the three different data bases.

4.5 A Case-Mix Measure for Long-Term Care Facilities

One of the purposes of deriving a patient classification system was to evaluate the potentially differing case mixes in long-term care (LTC) facilities, as measured by the resources required to care for their patient populations.

To demonstrate the development of such a case-mix measure, we evaluated the case-mix of the 76 facilities in Litchfield and New Haven counties. We employed the PSRO II data base consisting of all the patients reviewed by the PSRO review coordinators during the 15-months in which reviews were performed. Using the latest review for each of the 8871 federally-funded patients in 76 facilities, we classified each patient under each of the three classification systems: PSRO, B74 and B77 RUGs. Exhibit 4-36 displays the distributions across groups of each system for each of the facilities, with the mean percentage of patients in each group given in Exhibit 4-37. It can be seen that there is considerable heterogeneity of the percentages of patients in each group. For example, looking at the PSRO RUGs and restricting our attention to facilities with at least 25 patients, we see from 2% (Facility #151) to 41% (Facility #120) patients classified in RUG #1 (Exhibit 4-38).

In order to collapse these distributions across the groups of a classification system into a single number, weights were derived for each system. For example, we determined which of the 1615 patients in the PSRO sample would fit into the first of the PSRO RUGs, then computed the average time classification for these patients to be used as the weight for that terminal group (RUG), and so forth for each of the terminal groups. As discussed earlier, a total of three sets of weights could have been derived for each of the three systems by evaluating each RUG system on each data set. Given that the three patient classification systems were close to coincident, as shown by the Klastorin analysis, we decided to derive weights for each of the RUGs using only the PSRO II dataset. Subsequent analysis showed that the other six possible combinations would have given similar results to those found here. The derived weights for each classification system are given in Exhibit 4-39.

Combining the distributions of patients in each facility with the weights, we derived an average time classification (for the PSRO RUGs) or

Exhibit 4-35

Comparison of Three RUG Systems

PSRO DATABASE

Measures of Agreement	Comparison PSRO vs B1974	PSRO vs B1977	B1974 vs B1977
Proportion of Agreement	.88	.90	.96
Corrected Proportion of Agreement	.14	.13	.24
Kappa (Index of Agreement)	.54	.57	.86
Variance of Kappa	1.9 X E-6	1.4 X E-6	2.1 X E-6
Z Statistic	387.50	483.93	589.11

BATTELLE 1977 DATABASE

Measures of Agreement	Comparison PSRO vs B1974	PSRO vs B1977	B1974 vs B1977
Proportion of Agreement	.91	.92	.96
Corrected Proportion of Agreement	.20	.19	.24
Kappa (Index of Agreement)	.68	.71	.86
Variance of Kappa	3.6 X E-6	2.2 X E-6	2.9 X E-6
Z Statistic	359.88	479.13	510.39

BATTELLE 1974 DATABASE

Measures of Agreement	Comparison PSRO vs B1974	PSRO vs B1977	B1974 vs B1977
Proportion of Agreement	.91	.92	.97
Corrected Proportion of Agreement	.23	.22	.29
Kappa (Index of Agreement)	.71	.74	.91
Variance of Kappa	1.2 X E-5	1.3 X E-5	9.5 X E-6
Z Statistic	205.00	207.51	294.84

Exhibit 4-36

Comparison of Case Mix for 76 Skilled Nursing Facilities in New Haven and Litchfield Counties and a Case-Mix Measure

Facil. No.	Obs.	Number of Patients in RUG 1	2	3	4	5	6	7	8	9	Average Classif.	Case Mix Index	Standard. Index
100	55	13	8	4	8	7	5	3	6	1	2.91	.915	-1.48
101	136	20	20	38	1	9	12	3	27	6	3.10	.976	- .29
102	195	38	15	37	5	12	25	19	34	10	3.16	.995	.08
103	195	33	30	24	9	30	15	15	28	11	3.09	.971	- .39
104	137	30	18	22	1	7	16	10	25	8	3.10	.976	- .30
105	177	45	30	11	10	17	8	18	30	8	2.99	.941	- .98
106	195	53	19	31	5	16	26	10	30	5	3.00	.942	- .95
107	168	19	17	74	0	3	3	16	23	13	3.16	.994	.05
108	353	70	42	66	11	34	32	14	53	21	3.09	.973	- .36
109	80	15	17	8	0	7	4	6	16	7	3.11	.978	- .25
110	168	20	31	20	1	17	26	11	30	12	3.21	1.008	.34
111	44	8	12	6	3	3	0	3	9	0	2.90	.913	-1.52
112	38	5	8	3	1	4	4	9	2	2	3.13	.983	- .16
113	133	16	13	38	2	17	9	13	20	5	3.16	.993	.04
114	509	89	35	73	20	56	75	42	83	36	3.21	1.010	.37
115	182	19	32	30	6	21	17	15	36	6	3.16	.993	.05
116	25	7	3	5	1	3	1	0	5	0	2.89	.910	-1.59
117	233	23	18	61	0	31	21	16	38	25	3.30	1.038	.92
118	167	40	15	26	3	15	20	10	22	16	3.12	.980	- .22
119	80	4	11	17	0	9	7	10	15	7	3.33	1.050	1.14
120	83	34	7	10	1	6	5	8	5	7	2.87	.901	-1.75
121	186	40	23	47	1	9	8	16	23	19	3.09	.971	- .39
122	168	14	11	41	1	20	17	22	11	31	3.39	1.067	1.49
123	100	11	8	29	1	11	9	11	11	9	3.24	1.018	.53
124	156	23	17	32	2	11	12	22	18	19	3.24	1.020	.56
125	240	9	21	45	2	36	34	16	13	65	3.53	1.109	2.30
126	27	3	3	4	0	5	2	1	9	0	3.24	1.021	.58
127	62	16	6	10	0	6	2	7	13	2	3.06	.963	- .54
128	227	32	22	49	6	19	17	25	35	21	3.23	1.015	.46
129	10	4	2	0	0	2	0	1	1	0	2.71	.852	-2.72
130	23	1	2	0	4	7	1	1	6	1	3.30	1.036	.89
131	34	6	3	8	2	3	2	7	3	0	3.06	.961	- .59
132	81	11	3	11	0	16	9	10	11	10	3.35	1.055	1.24
133	142	17	14	22	3	10	12	28	21	15	3.32	1.045	1.06
134	175	32	16	45	1	10	18	28	14	10	3.12	.982	- .18
135	174	40	14	32	5	10	12	18	38	5	3.10	.976	- .29
137	77	8	11	8	2	15	5	2	12	14	3.32	1.044	1.03
138	155	27	20	21	3	19	21	12	22	10	3.14	.989	- .05
139	131	6	16	30	4	9	15	17	32	2	3.30	1.039	.93
140	119	14	20	27	5	12	8	15	15	3	3.09	.971	- .40
141	27	3	3	5	2	4	1	5	2	2	3.18	1.000	.17
142	55	3	8	9	0	9	11	6	9	0	3.24	1.020	.57
143	91	9	11	7	7	17	13	7	19	1	3.21	1.009	.34

Facil. No.	Obs.	Number of Patients in RUG 1	2	3	4	5	6	7	8	9	Average Classif.	Case Mix Index	Standard. Index
144	66	10	11	14	1	8	4	6	9	3	3.08	.967	- .47
145	114	6	14	15	7	14	12	16	26	4	3.32	1.043	1.01
146	62	2	3	15	0	4	10	10	14	4	3.47	1.092	1.96
147	179	61	30	21	2	15	12	15	14	9	2.84	.894	-1.90
148	166	18	29	22	5	26	11	16	15	24	3.22	1.014	.45
149	124	27	9	15	2	12	8	4	33	14	3.24	1.020	.56
150	22	3	2	0	0	7	5	0	5	0	3.23	1.015	.46
151	102	2	2	30	1	12	6	28	7	14	3.49	1.098	2.09
152	83	13	9	8	5	13	19	8	11	6	3.18	1.000	.17
153	30	3	3	10	0	3	0	2	8	1	3.21	1.010	.37
154	168	36	16	21	10	12	35	10	22	6	3.09	.970	- .39
155	92	13	9	14	4	25	9	2	12	4	3.11	.979	- .23
156	68	15	9	12	2	4	10	3	10	3	3.04	.957	- .67
157	45	1	5	6	1	7	2	7	7	9	3.52	1.106	2.24
158	27	3	2	7	0	4	2	3	5	1	3.23	1.017	.50
159	148	15	16	25	3	26	9	21	23	10	3.25	1.023	.63
160	21	4	2	2	5	1	2	0	3	2	3.06	.962	- .57
161	39	9	6	3	2	7	5	0	6	1	2.97	.935	-1.09
162	30	5	4	5	0	2	2	5	6	1	3.17	.997	.12
163	237	70	32	27	10	18	26	8	33	13	2.95	.928	-1.24
164	136	13	12	28	1	21	11	17	22	11	3.30	1.036	.88
165	66	16	9	11	0	7	3	5	8	7	3.06	.963	- .54
166	17	1	5	3	1	1	2	0	4	0	3.06	.961	- .59
167	116	14	9	12	8	16	26	9	18	4	3.24	1.019	.54
168	62	6	13	10	1	12	7	4	7	2	3.08	.970	- .41
169	298	109	38	27	6	10	27	4	66	11	2.91	.914	-1.50
170	64	4	8	17	2	8	4	17	1	3	3.20	1.006	.29
171	23	2	3	4	2	5	2	1	3	1	3.14	.986	- .10
172	91	6	8	25	0	12	11	13	7	9	3.31	1.040	.95
173	102	19	24	27	2	3	3	8	11	5	2.93	.922	-1.34
174	34	1	2	5	3	7	9	3	1	3	3.34	1.051	1.17
175	134	34	16	25	1	22	9	10	5	12	2.98	.939	-1.03
176	5	2	1	0	0	0	1	0	1	0	2.81	.884	-2.10

Exhibit 4-37

Mean Percentage of Patients in Each RUG for
New Haven and Litchfield Counties
(3 Systems)

	PSRO	B74	B79
1	16.8%	14.2%	14.3%
2	11.6	11.5	11.6
3	17.6	3.1	3.2
4	2.6	31.4	14.5
5	10.6	14.8	16.6
6	9.8	5.6	14.8
7	8.9	19.2	5.7
8	14.9	-	19.4
9	7.3	-	-

Exhibit 4-38

Range of Percentage of Patients in Each PSRO Resource Utilization Group for 76 Connecticut Facilities

PSRO RUG	Low			High			Mean % for all Facilities
	Percent Patients	Number of Patients	Facility Number	Percent Patients	Number of Patients	Facility Number	
1	2.0	2	151	41.0%	34	120	16.8%
2	2.0	2	151	27.9	12	111	11.6
3	5.6	3	100	31.0	9	153	17.6
4	0.0	0	107	14.8	8	100	2.6
5	1.8	3	107	27.2	25	155	10.6
6	0.0	0	111	26.5	9	174	9.8
7	0.0	0	161	27.5	28	151	8.9
8	1.6	1	170	33.3	9	126	14.9
9	0.0	0	111	27.1	65	125	7.3

Facilities dropped because of small size (less than 25 patients):
Facility numbers 129, 130, 150, 160, 166, 171, 176.

Exhibit 4-39

Weights and Standardizing Constants
for Three RUG Systems

Weights for Resource Utilization Groups*

RUG	PSRO	B74	B79
1	2.07	2.02	2.02
2	2.39	2.39	2.39
3	3.01	2.94	2.94
4	2.81	3.20	2.97
5	3.20	3.35	3.39
6	3.60	3.61	3.35
7	3.72	4.15	3.61
8	3.92		4.15
9	4.47		

Standardization Constants for 76 Connecticut Facilities**

RUG System	Mean	Standard Deviation
PSRO	3.152	.163
B74	3.152	.149
B77	3.152	.150

---

*Weights represent mean time classification for each RUG, as calculated for PSRO II patient population (n=1615).

**Standardized index is computed as: Index = (weighted value-mean)/(st.dev.)

average aide time (for the two Battelle RUGs) for each facility. The final step was to standardize each facility case-mix measure by reducing each such average value by the overall average for all facilities, and divide by the standard deviation. For example, for Facility #100 an average time classification of 2.911 was computed by weighting the number of patients in each of the PSRO RUG categories. The overall average for all classifiable patients was 3.15 with a standard deviation over the 76 facilities of .163, resulting in a standardized classification of -1.47 for Facility #100. The standardized case-mix indexes represent the relative resource consumption of patients in a facility compared with the regional average. The average facility would have an index of 0, whereas a facility with a patient population requiring more than the average resources would have a positive index, one with less "costly" patients a negative index.

Exhibit 4-40 displays the standardized indexes under each of the three classification systems for the 76 facilities, and these values are plotted in Exhibits 4-41 through 4-43. Identifying those facilities with the highest case-mix index (Facilities 125, 146, 151, and 157) and those with the lowest (Facilities 120, 129, 147 and 176), we see that they are consistently either high or low for all three classification systems. Better evidence of the close relationship between the three case-mix indexes can be seen in the Pearson correlation coefficients (Exhibit 4-44). Each coefficient is greater than .945 showing excellent fit. Again, as expected, the structurally similar B74 and B77 RUGs were almost coincident.

Finally, the best evidence of the direct relationship between the indicies is demonstrated by the scatterplots relating pairs of variables (Exhibits 4-45 and 4-46) in which the indicies for each facility are commensurate, with no points observed which deviate significantly from a straight-line relationship.

4.6 Relationship of Cost and Case-Mix

The essay available as Appendix B describes a study, performed parallel with the major effort described here, to understand the underlying cost relationships in nursing home care.

This analysis used multiple regression on the cost data for all Connecticut nursing homes, using this method to control costs for differences in ownership, level of care, payment sources, input (factor) prices, etc. The econometric model was intially estimated on a subset of facilities, then applied to all Connecticut facilities for the 1978 fiscal year. The same model was shown to pertain to the full dataset. Exhibit 4-47 reproduces the table from the study displaying these results.

The major finding of this study is that no economies of scale can be demonstrated in nursing homes, and that, in fact, statistically significant diseconomies of scale exist in the Housekeeping and Nursing Service cost centers. For all other cost centers and for total operating costs, no evidence was found that large SNFs were less costly than small SNFs.

Exhibit 4-40

Standardized Case-Mix Indexes for 76 LTC Facilities
(Three Systems)

Facility	PSRO	B74	B77
100	-1.48	-1.82	-1.82
101	-0.29	-0.13	0.09
102	0.08	0.46	0.56
103	-0.39	-0.48	-0.56
104	-0.30	-0.08	-0.13
105	-0.98	-1.54	-1.61
106	-0.95	-0.83	-0.81
107	0.05	0.36	0.88
108	-0.36	-0.05	0.08
109	-0.25	-0.13	-0.15
110	0.34	0.22	0.21
111	-1.52	-1.69	-1.81
112	-0.16	-0.81	-0.86
113	0.04	-0.03	0.25
114	0.37	0.38	0.33
115	0.05	0.20	0.35
116	-1.59	-1.45	-1.59
117	0.92	1.03	1.10
118	-0.22	-0.17	-0.17
119	1.14	1.11	1.07
120	-1.75	-2.00	-2.16
121	-0.39	-0.28	-0.18
122	1.49	1.07	1.13
123	0.53	0.41	0.58
124	0.56	0.58	0.46
125	2.30	2.01	1.92
126	0.58	0.17	0.44
127	-0.54	-0.29	-0.50
128	0.46	0.59	0.59
129	-2.71	-2.12	-2.23
130	0.89	0.37	0.62
131	-0.59	0.05	-0.05
132	1.24	1.02	0.67
133	1.06	0.67	0.74
134	-0.18	-0.34	-0.19
135	-0.29	-0.35	-0.20
137	1.03	0.70	0.60
138	-0.05	-0.01	-0.15
139	0.93	1.30	1.33
140	-0.40	-0.50	-0.22

Facility	PSRO	B74	B77
141	0.17	0.65	0.49
142	0.57	0.42	0.35
143	0.34	0.31	0.31
144	-0.47	0.03	-0.06
145	1.01	1.08	0.97
146	1.96	2.03	2.08
147	-1.90	-2.27	-2.16
148	0.45	-0.09	-0.18
149	0.56	0.71	0.73
150	0.46	1.11	0.79
151	2.09	1.70	1.57
152	0.17	0.14	0.08
153	0.37	1.21	1.11
154	-0.39	-0.27	-0.27
155	-0.23	-0.20	-0.17
156	-0.67	-0.71	-0.52
157	2.24	1.79	1.96
158	0.50	1.05	1.17
159	0.63	0.58	0.29
160	-0.57	-0.35	-0.41
161	-1.09	-1.12	-1.13
162	0.12	0.18	0.32
163	-1.24	-1.33	-1.34
164	0.88	1.03	0.90
165	-0.54	-0.81	-0.96
166	-0.59	-0.42	-0.48
167	0.54	0.62	0.58
168	-0.41	-0.23	-0.38
169	-1.50	-1.30	-1.30
170	0.29	0.10	0.04
171	-0.10	0.61	0.43
172	0.95	0.79	0.59
173	-1.34	-1.33	-0.99
174	1.17	0.58	0.72
175	-1.03	-1.43	-1.25
176	-2.10	-2.44	-2.46

Exhibit 4-41
Scatterplot of PSRO Standardized Index by Facility

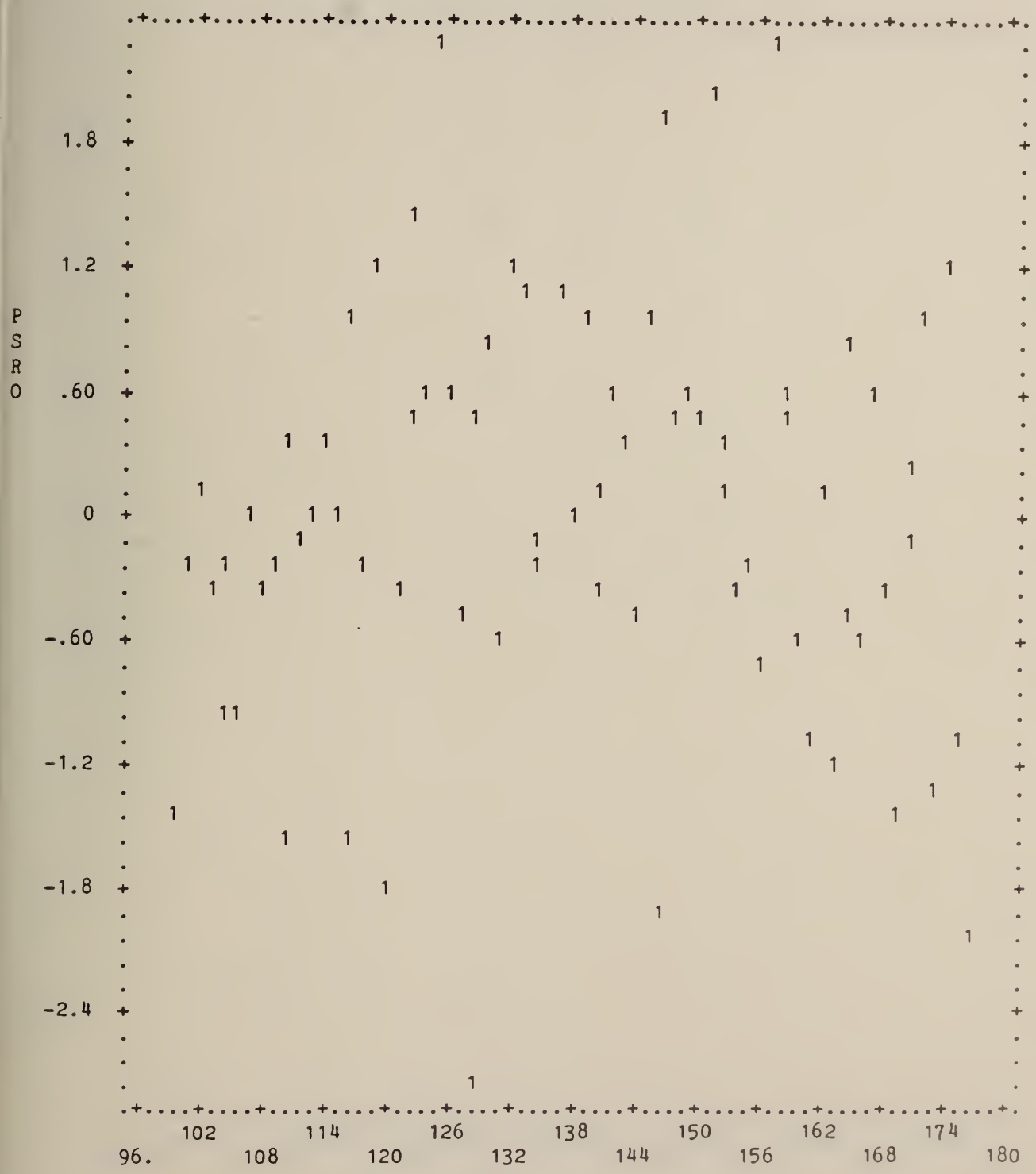


Exhibit 4-42
Scatterplot of Battelle 1974 (B74) Standardized Index by Facility

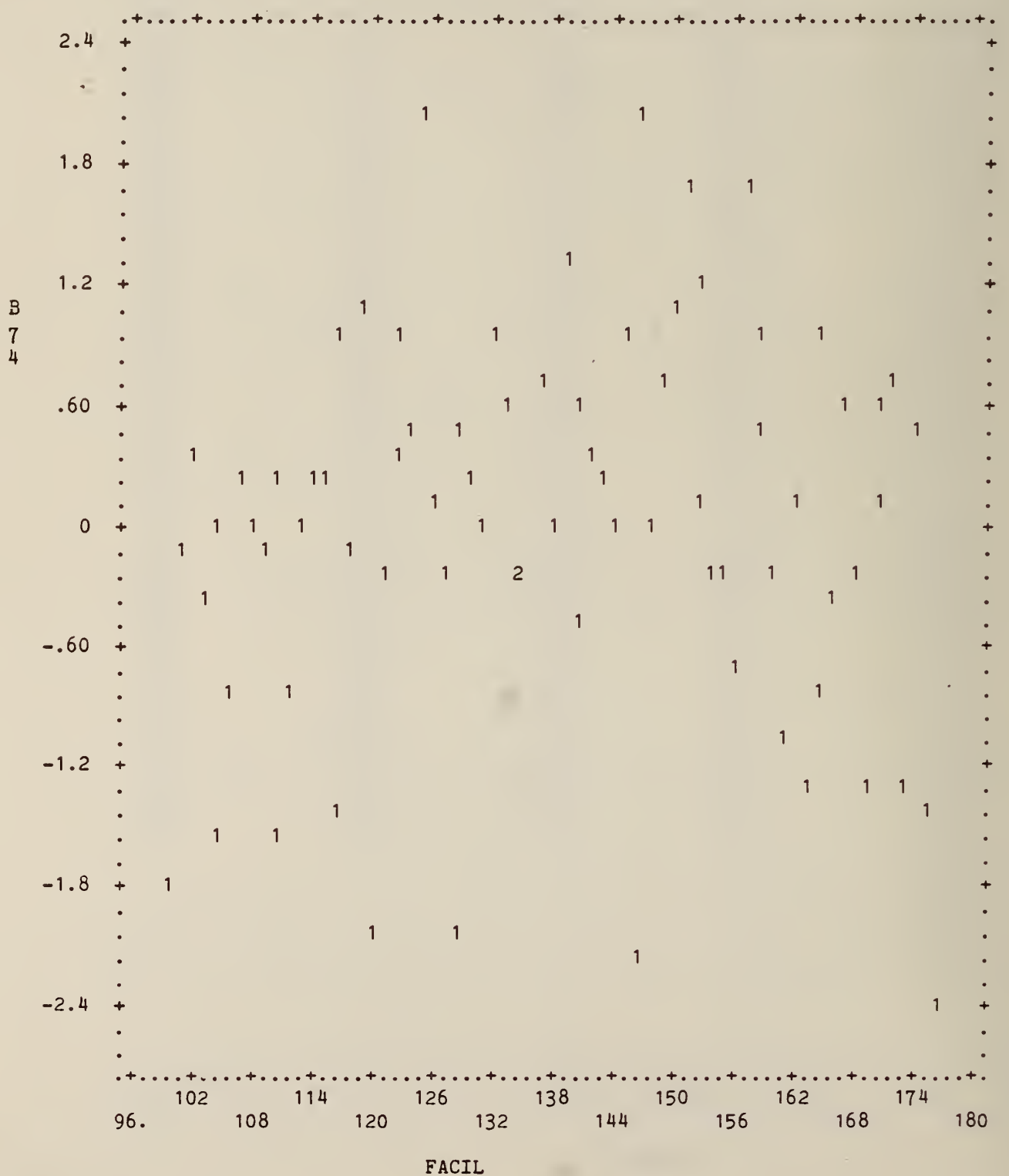


Exhibit 4-43
Scatterplot of Battelle 1977 (B77) Standardized Index by Facility

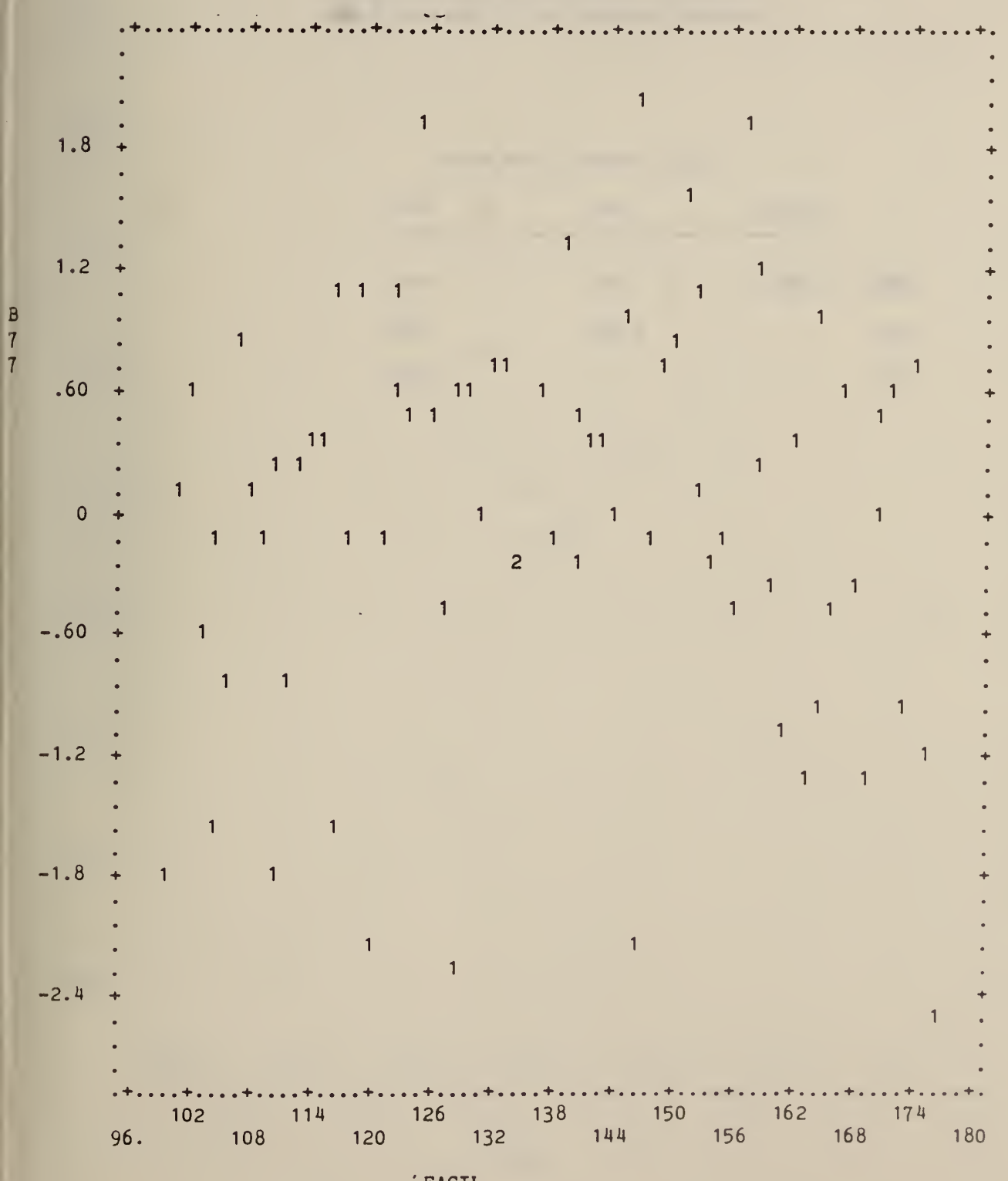


Exhibit 4-44

Pearson Correlations Between Three
Case-Mix Indexes for 76 Nursing Homes

Index Derived from RUGs:

	PSRO	B74	B77
PSRO	1.000	.946	.945
B74		1.000	.986
B77			1.000

Exhibit 4-45
Scatterplot of PSRO Standardized Index vs.
Battelle 1974 Standardized Index

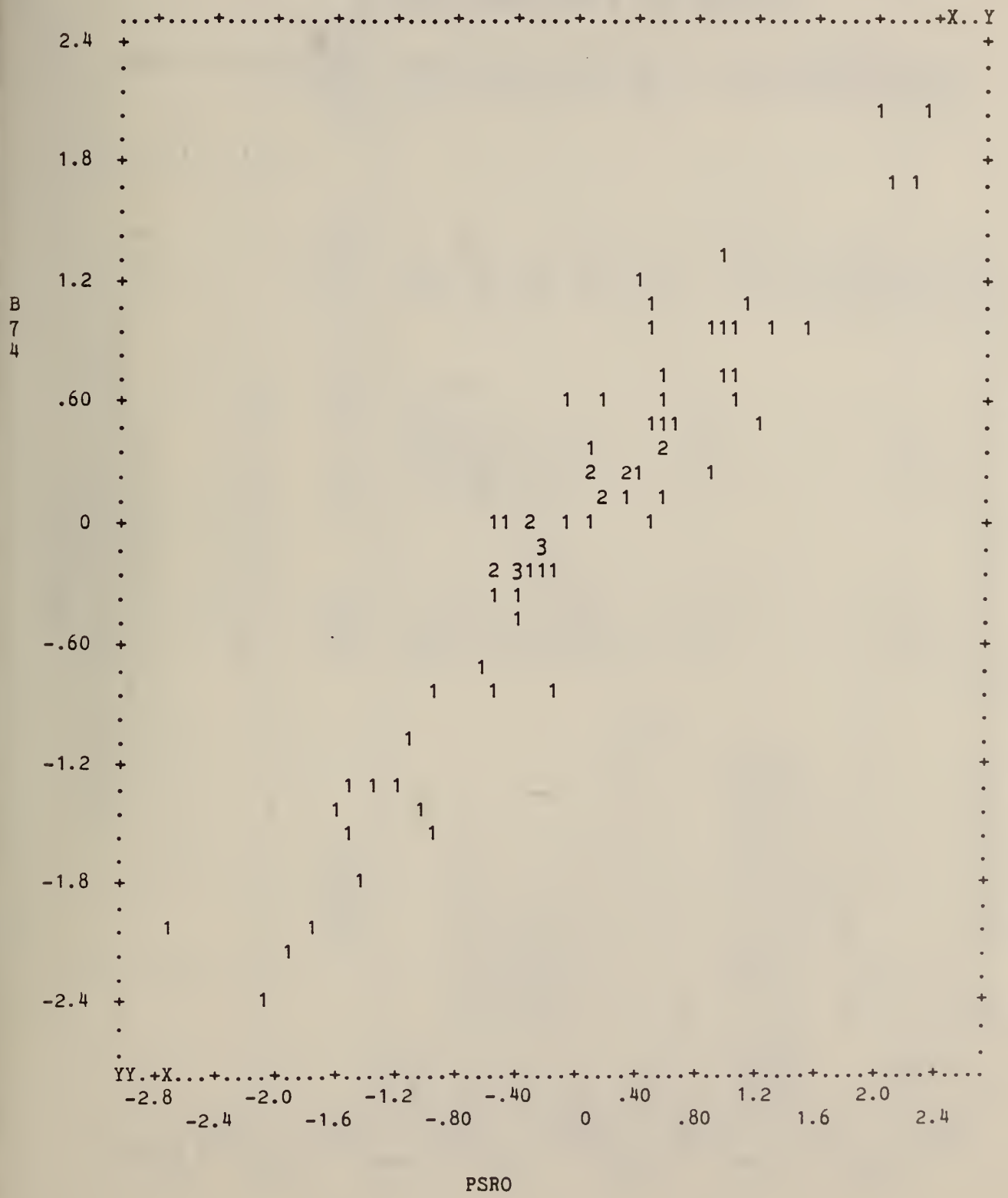


Exhibit 4-46
Scatterplot of Battelle 1974 Standardized Index vs.
Battelle 1977 Standardized Index

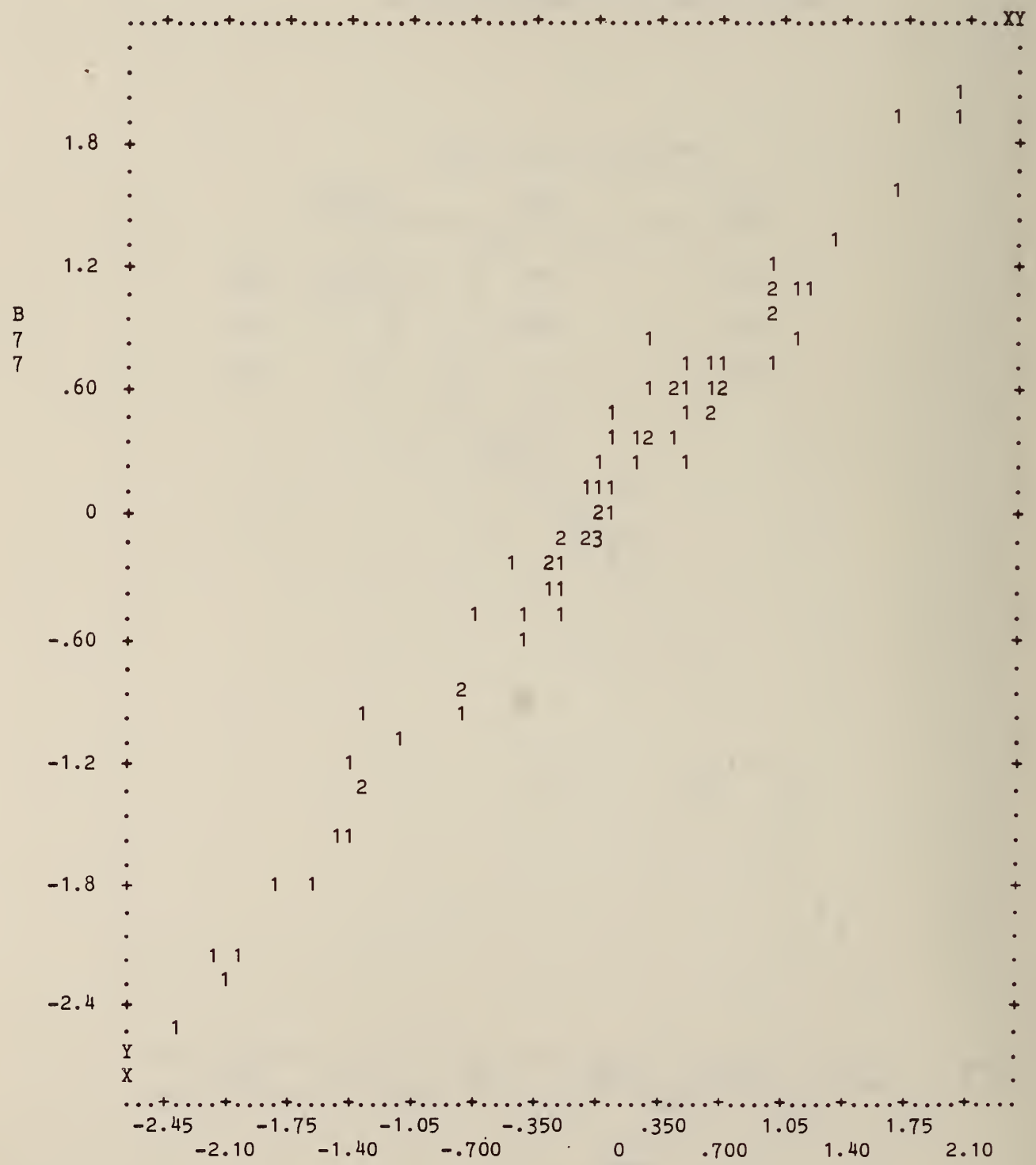


Exhibit 4-47

Comparison of Multiple Regression Results:
Average Operating Costs

PSRO II and Entire State (1978)

Independent Variables	(1) Best Model: PSRO II	(2) Model (1) Applied to Entire State	(3) Best Model: Entire State	(4) Model (3) using SNFATC as dependent variable
INTERCEPT	5.463*	2.033	3.299**	4.012*
	(2.28)	(1.50)	(3.06)	(2.44)
NURSDY: RN + LPN + Aide Salaries per Patient Day	1.260***	1.846***	1.473***	1.453***
	(4.88)	(14.72)	(14.48)	(9.39)
FOODDAY: Raw Food Expense per Patient Day	2.899**	2.710***	2.997***	3.716***
	(3.47)	(5.53)	(7.88)	(6.43)
HEATBED: Heating Expense Per Bed	0.0147**	0.00665**	0.00534**	0.0123***
	(3.14)	(2.81)	(2.71)	(4.12)
UTILBED: Life + Power + Water Expense per bed	---------	---------	0.0193***	0.0244***
			(9.00)	(7.47)
NURSDY*UTILBED: Interaction	0.00115**	0.000711***	---------	---------
	(2.88)	(4.29)		
HEATBED*OWN: Additional Effect of HEATBED on SNFAOC if facility is a not-for-profit	---------	---------	0.00972***	0.00479
			(4.43)	(1.44)
UTILBED*HSA: Additional Effect of UTILBED if SNF is in -- North Central HSA	---------	---------	-0.0165***	-0.0108**
			(-6.86)	(-2.94)
Eastern, Northwest, or South Central HSA	---------	---------	-0.0119***	-0.0118***
			(-5.25)	(-3.43)
R - Square	0.7921	0.7725	0.9038	0.8300
F - Value for Model	48.57***	157.02	214.65***	111.56***

NOTE: T-Values in parentheses (T = parameter estimate/standard error of that estimate)

*p=0.05 or less **p=0.01 or less ***p=0.001 or less

Other results included:

- SNFs with higher operating costs tend to have significantly higher unit costs for heating, utilities, raw food, and direct nursing care

- the effect of unit heating costs was stronger for voluntary (nonprofit) SNFs

- the combination of staff time per patient day, raw food expense per patient day, heating expense per bed, and utility expenses explained 83% of the variation in SNF average operating cost.

The analysis described thus far was done prior to the determination of a case-mix index using RUGs. The availability of measures of resource utilization enabled another level of analysis to be performed: the evaluation of cost relationships in nursing homes in Connecticut, adjusting for case-mix.

First, we showed that the original regression model described above remained valid for 1980. Only the interaction term between nursing costs and utility costs per bed day which was significant in the 1978 model dropped in importance.

Next, a multivariate regression model was run, using 1980 fiscal data, for those facilities in New Haven and Litchfield Counties for which we had case-mix indicies we considered representative of the SNF's patient population -- a total of 62 facilities. The variables considered, listed in Exhibit 4-48, included the variables found important in all of the other regression models, case-mix indicies derived from both the PSRO and Battelle RUGs, and a quality of care index. The quality of care index, currently used experimentally by Connecticut, is based on weighted deficiencies in nursing homes services.[57]

The results are displayed in Exhibit 4-49. The same variables identified in the original econometric models described above were again significant, although a new variable -- proportion of patient days attributable to medicaid patients -- was also shown to be statistically significant and negatively related. This finding is consistent with the logic that nursing homes with higher proportions of Medicaid patients tend to have lower costs, possibly due to the lower reimbursement rates of the Medicaid system. The measure of quality of care was unrelated to cost, a finding which was perhaps comforting given our reservations concerning the validity of this measure.

In addition, the two case-mix measures were statistically significant, but negatively. There are several possible explanations of this finding which demonstrates a problem in this phase of analysis:

- The case-mix index for each facility was determined based only upon the federally-funded patients in that facility, an estimated 60.3% (in total) of the full patient population. Thus the index assigned may not be representative of the facility as a whole. For example, it is quite possible that a negative relationship exists between the care requirements of the Medicaid population and of the rest of the patients in a facility.

Exhibit 4-48

Variables Used in Multiple Regression Model
for Average Operating Costs

Dependent VAriable

SNFAOC	Average operating cost per patient day: Total cost less interest, depreciation, amortization, and property tax costs, divided by total patient days

Independent Variables

NURSDY	RN, LPN, Aide salary expense per patient day
FOODDAY	Raw food cost per patient day
HEATBED	Heating expense per bed
UTILBED	Utility expenses per bed
PCTMEDD	CT Medicaid patient days as proportion of all days
PCTMEDR	CT Medicare patient days as proportion of all days
PCTMEDO	Out-of-State Medicaid patient days as a proportion of all days
PCTPRI	Private pay patient days as a proportion of all days
PDTOT	Total patient days
QUAL	Quality of care index
OWNER	Ownership (not-for-profit, for-profit)
LEVEL	Level of care (multilevel, only SNF)
D7B7AVG	Case-mix index from B77 RUGs
PAVG	Case-mix index from PSRO RUGs

Exhibit 4-49

Multiple Regression Results for Fiscal Year 1980 Cost Models, Using Average Operating Cost (SNFAOC) as the Dependent Variable

Variable	Regression using B74 RUG case-mix index		Regression using PSRO RUG case-mix index	
	Coefficient	Significance	Coefficient	Significance
NURSDY	1.45	p<.001	1.44	p<.001
FOODDAY	2.09	p<.001	2.28	p<.001
HEATBED	0.01	p<.001	0.01	p<.001
UTILBED	0.01	p<.05	0.01	p<.05
PCTMEDD	-	ns*	-	ns
PCTMEDR	-	ns	-	ns
PCTMEDO	-	ns	-	ns
PCTPRI	-	ns	-	ns
PDTOT	-	ns	-	ns
QUAL	-	ns	-	ns
OWNER	-	ns	-	ns
LEVEL	-	ns	-	ns
D7B7AVG	-0.09	p<.05	na	na
PAVG	na	na	-5.54	p<.05

*not significant at the .05 level

- The latest cost data available was for the fiscal year 1980 whereas the case-mix measures were derived in for patient population in the middle of calendar year 1981, so changes in patient populations would certainly have occurred.

- Reimbursement in Connecticut is based on budgetary review of financial data, the data used in our model, with costs eventually becoming part of facilities' reimbursement. We have reason to believe from this work and other studies performed by these authors[58] that there is little relationship between the staffing of facilities and the cost of running them and case-mix. Unless facilities are managed in such a way that costs are controlled to fit closely with needed services for patients, there may well be a random relationship between cost and case-mix.

We feel that the methodology employed here is a valid approach to understanding the cost relationships in nursing homes, and that the technical problems indicated could be overcome in further research.

5. Discussion and Conclusions

This study produced three major results. First, subjective estimates by nursing home personnel of the relative intensity of care required by their patients were found to be good surrogates for the resource utilization by these patients. The estimates were closely correlated with actual observed care needs, fell evenly along a scale from lowest to highest care, and produced results quite similar to other studies using measured aide time as a surrogate of resource utilization.

Second, the patient variables which correlated best with staff estimates of intensity of care were activities of daily living (ADL) variables, that is, the ability to dress, toilet, feed, and bathe oneself, the ability to ambulate and transfer, and continence of bladder and bowel. These same ADL variables were the best predictors of aide time in the two Battelle studies,[59,60] where the dependent variable was actual measured aide time. Flagle's study,[61] also measuring actual aide time, found as well that the ADL variables were the most important predictors of staff time requirements. In addition, three earlier studies, using less direct measures of resource requirements, demonstrated these same variables as the most important predictors.[62-64]

We feel that our study of both our own data and that of the Battelle Institute confirms the importance of these patient characteristics in predicting the care resources expended on patients in long-term care facilities. Although not directly addressing this issue, it may well be that these characteristics are also indicative of the needs of these patients, the "difficulty" of caring for these patients and their their case "complexity."

The third and most important result of our study was our ability to use these patient characteristics to develop groups of patients requiring similar amounts of staff time for their care. This allows, for the first time, the use of these characteristics to determine the relative care needs of groups of patients. The groups are easily understood, and the need to compute formulaic indicies is avoided. The nine groups of patients varied in the care provided from a mean of 2.1 to 4.5, on a scale of 1 to 5. By determining what percentage of patients in a facility falls into each of these groups, one can develop a true case-mix of the intensity of care of LTC patients.

It is impressive to see the ability of these groups, formed with a very small number of characteristics, to capture the differences perceived between patients on other dimensions. For example, while the groups in themselves say nothing about bladder continence, it is reasonable to assume that patients who are able independently to dress themselves will probably have little problems with bladder control. In the same manner, one would expect that patients who require total care with feeding might have a substantial problems with bladder control. This assumption was borne out by our analysis, as only one percent of the Resource Utilization Group 1, those independent in dressing, were incontinent of urine. Sixty-eight percent and forty-four percent of the last two groups, those requiring total care with feeding, were incontinent of urine. Similar correlations were found for confusion, total care with toilet, and inability to transfer.

We have therefore developed a grouping system which can give a detailed analysis of the relative care needs of patients in LTC facilities using a

small number of important LTC patient characteristics. Although the system was derived from data collected in a single geographic region, from only federal patients in that region, and based on subjective estimation of staff time, the system is consistent with others we derived from data collected elsewhere.

The use of the variable "intake-output" in the PSRO grouping system is troublesome, and deserves more attention. Although this variable could be replaced by the variable "reason for placement" without great reduction of effect, we nevertheless preferred the B77 RUG system. This system is felt superior as the ADL variables take on only three values: function by self, with help, or totally by others. We feel this trichotomy is easier to differentiate and thus more reliable. However, further research is needed with a larger dataset to determine if more than eight groups would be effective in differentiating patients.

The grouping systems were used to develop a case-mix index for skilled nursing facilities in New Haven and Litchfield Counties in Connecticut. This analysis was possible because of an exhaustive data collection of the characteristics of federal patients, performed by PSRO II in its utilization review activities. This analysis showed a significant range in the care needs of the patient populations of different facilities. For example, the percentage of patients classified in the least intensive patient group range from 2% to 41%. These differences are not surprising as 86% of nursing home beds in Connecticut are licensed as skilled nursing facilities. This has resulted in a very heterogeneous group of patients occupying these SNF beds. PSRO II found that less than 3% of the patients in New Haven and Litchfield County's SNFs met the federal criteria for such facilities. As the lack of less intense intermediate care facility beds in Connecticut make utilization review efforts rather futile, it is not surprising to find such a varying case-mix.

The ability of the Resource Utilization Groups to develop a case-mix of relative care use is extremely important. State and federal requirements for licensed nurse staff, physical therapists, recreational therapists, and other personnel are traditionally made in the absence of any hard information about the care needs of patients. In addition, the ability of facilities to increase their State reimbursement by adding reimbursable staff has little to do with the true care needs of their patients. With the increasingly finite amount of long-term care resources available for the ever-expanding long-term care population, it is extremely important to improve the match between patient need and resource provision. This index of case-mix provides some of the first hard information on which to make these decisions.

The amount of care provided to long-term care patients, of course, is but one variable in determining the necessity and appropriateness of resource provision. Although the RUGs were derived to explain staff time of aides and nurses, we suggest that it may be as well a surrogate measure of other resource use, both staff and equipment. Quality of care is extremely difficult to measure and rate. By first providing an accurate measure of the case-mix of patient needs, one should then be able to more accurately measure the quality of care delivered and the efficiency with which it is provided.

We believe that we have demonstrated that the Resource Utilization Groups are a practical method of measuring the relative care needs of long-term care

patients. The patient characteristics we have chosen are both objective and easily obtainable for a large number of institutionalized patients. As such, the RUGs could begin to provide the basis of a reimbursement system which is tied to the resources required by LTC patients.

In a recent article, Willemain has addressed the issue of paying for the "right" amount of services received by each nursing home resident. He points out, as we indicated in Section 1, that the reimbursement must match the resources expended on patients.[65] In this context, he compared three systems of nursing home reimbursement:

- A system with two classes, of residents each reimbursed at its own fixed rate (the analog of the current SNF/ICF system);

- A system in which rates are computed individually for each patient ("patient-centered reimbursement");

- A system in which the care of each resident in a nursing home is paid for at the same rate; the rate is equal to the average of the patient-centered rates for a sample of patients in that home ("case-mix reimbursement").

The author concluded that, in view of the "bias and precision of resident assessment techniques and the diversity and volatility of resident need," case-mix reimbursement performed best in most situations.

We concur with this appraisal, although we believe that the case-mix indices derived should not be used as a sole means of determining the reimbursement of long-term care facilities. Rather, we feel that these measures do provide objective data by which the true cost of caring for LTC patients can be measured. The case-mix indices, however, must be adjusted for the quality of care provided. Such an index may complement such innovative suggestions for long-term care compensation such as Kane's Prognostic Adjustment Factor,[66] and these indicies may be used in determining baseline cost levels for different groups of patients.

The Resource Utilization Groups derived in our work here are a preliminary tool for the analysis of long-term care systems. Further research is needed to show that they are stable over time and to show them consistent across data from different sources. Stability over time, i.e., that patients do not move rapidly from one RUG to another, is important if this type of system is to be used for either reimbursement or evaluation; rapid movements would make measurements uncertain. Although the RUGs were demonstrated to be constant over three datasets, a variety of other tests could be envisioned. Finally, the RUGs could be refined, with more groups identified, if larger data bases were available. Our result that subjective estimation is effective may enable the expensive effort of time-and-motion studies to be circumvented and such data to be collected.

References

Section 1

1. Kingson, E.R. and Scheffler, R.R. "Aging: Issues and Economic Trends for the 1980s" Inquiry 18:197-213 (Fall) 1981.

2. Fox, P.D. and Clauser, S.B. "Trends in Nursing Home Expenditures: Implications for Aging Policy" Health Care Financing Review 2(2):65-70 (Fall) 1980.

3. Scanlon, W. et al. "A Framework for Analysis of the Long Term Care System" in Long Term Care: Current Experience and a Framework for Analysis Washington, The Urban Institute, 1979, pp. 48-132.

4. Willemain, T.R. "Nursing Home Levels of Care: Reimbursement of Resident Specific Costs" Health Care Financing Review 2(2):47-52 (Fall) 1980.

5. Vladeck, B.C. Unloving Care: The Nursing Home Tragedy Basic Books, New York, 1980.

6. Birnbaum, H. et al. "Why Do Nursing Home Costs Vary?" Medical Care 19(11):1095-1109 (Nov.) 1981.

7. Shapiro, R. Long Term Care and Patient Assessment unpublished Masters' Thesis, Yale University, Department of Epidemiology and Public Health, 1978.

8. Connecticut Area II Professional Standards Review Organization, unpublished results.

9. National Center for Health Statistics "Charges for Care and Sources of Payment for Residents in Nursing Homes, U.S. National Nursing Home Survey August 1973 - April 1974" Vital and Health Statistics 13:32 1977.

10. Spitz, B. and Weeks, J. Medicaid Nursing Home Reimbursement in Illinois The Urban Institute, (Jan.) 1979.

11. West Virginia Department of Welfare: Medicaid Long Term Care System.

Section 2

12. Commission on Professional and Hospital Activities Hospital Mortality, PAS Hospitals U.S.A. 1972-73 Ann Arbor, Mich. (Dec.) 1975.

13. Fetter, R.B. et al. "Case Mix Definition by Diagnosis-Related Groups" Medical Care 18(2,Supplement) (Feb.) 1980.

14. Garg, M.L. et al. "Evaluating Inpatient Costs: The Staging Mechanism" Medical Care 16:191-201, (Mar.) 1978.

15. Horn, S.D. and Schumacher, D.N. "Comparing Classification Methods: Measurement of Variations in Charges, Length of Stay, and Mortality" Medical Care 20(5):489-500 (May) 1982.

16. Ament, R.P. et al. "Three Case-Type Classifications: Suitability for Use in Reimbursing Hospitals" Medical Care 20(5):460-467 (May) 1982.

17. Mills, R. et al. "AUTOGRP: An Interactive Computer System for the Analysis for Health Care Data" Medical Care 14:603-615, 1976.

18. Theriault, K. et al. The AUTOGRP Reference Manual, Working Paper No. W-857, Yale University, Center for Health Studies, 1978.

19. Williams, S.V. et al. "Improved Cost Allocation in Case-Mix Accounting" Medical Care 20(5):450-459 (May) 1982.

20. Fetter, R.B. et al., op. cit., pp. 29-35.

21. Health Systems Management Group Ambulatory Patient-Related Groups Yale School of Organization and Management, April, 1980.

22. Katz, S. et al. "Studies of Illness in the Aged: The Index of ADL" J. American Medical Association 195:914-919 (Sept. 21) 1963.

23. Katz, S. et al. "The Measurement of Long Term Care Needs and Impact" Health and Medical Care Systems Review 2:1-21, 1979.

24. Kane, R.A. "Physical Functioning in Long Term Care," Chapt. 2 in Kane, R.A. and Kane, R.L. eds. Assessing the Elderly Lexington Books, Lexington, Mass., 1981, pp. 25-66.

25. _____, op. cit.

26. Skinner, D.E. and Yett, D.E. "Debility Index for Long Term Care Patients" in Berg, R.L. ed. Health Status Indexes Hospital Research and Educational Trust, Chicago, 1973.

27. Parker, R. and Boyd, J. "A Comparison of Discriminate Versus a Clustering Analysis of a Patient Classification for Chronic Disease Care" Medical Care 12(11):944-957 (Nov.) 1974.

28. Swearingen, C. et al. A Methodology for Finding, Classifying and Comparing Costs for Services in Long Term Care Settings ABT Associates, (January 15) 1978.

29. Flagle, C. et al. Health Services in Long-Term Care The Johns Hopkins University and the Hospital Association of New York State, Report of USPHS Grant 5-R18-HS01250, (Nov.) 1977.

30. McCaffree, K. et al. Final Report of Cost Data Reporting System for Nursing Home Care Battelle Human Affairs Research Center, Seattle, Washington, 1976.

31. ---------- op. cit.

32. ---------- Long Term Care Case-Mix Compared to Direct Care Time and Costs Battelle Human Affairs Research Center, Seattle, Washington, 1979.

Section 3

33. Morgan, J.N. and Sonquist, J.A. "Problems in the Analysis of Survey Data and a Proposal" J. American Statistical Association 58:415-434 (Sept.) 1963.

34. U.S. National Committee on Vital and Health Statistics Uniform Hospital Discharge Data Set Final Summary Report 1975-1978.

35. Fetter, R.B. et al. The New ICD-9-CM Diagnosis Related Groups Classification Scheme, User Manual, Vol. I (Dec.) 1981.

36. Stratton, S.D. Statistical Analysis of Connecticut Nursing Homes unpublished Masters Thesis, Yale University, Department of Epidemiology and Public Health, 1982.

37. National Committee on Vital and Health Statistics The Long-Term Care Minimum Data Set U.S. Dept. of Health and Human Services, Publication (PHS)80-1158, (Aug.) 1980.

38. Katz et al. 1979, op. cit.

39. Katz et al. 1963, op. cit.

40. Swearingen et al., op. cit.

41. Flagle et al., op. cit.

42. McCaffree et al. 1976, op. cit.

43. McCaffree et al. 1979, op. cit.

44. McCaffree et al. 1976, op. cit.

45. Cavaiola, L.J. and Young, J.P. "An Integrated System for Patient Assessment and Classification and Nurse Staff Allocation for Long Term Care Facilities" Health Services Research 15:281-306 (Spring) 1980.

46. Klastorin, T.C. A Comprehensive Approach to the Partition Comparison Problem Working Paper, Graduate School of Business, University of Washington, Seattle (November) 1978.

47. Klastorin, T.D. and Watts, C.A. "On the Measurement of Hospital Case Mix" Medical Care 18(6):675-685 (June) 1980.

48. Fleiss, J. Statistical Methods for Rates and Proportions (Wiley, New York) 1973.

Section 4

49. "Nursing Shortage Still Exists in Long-term Care Facilities" Long-Term Care Newsletter, 12(5):3 (Feb. 4) 1983.

50. Katz et al. 1979, op. cit.

51. Swearingen et al., op. cit.

52. Flagle et al., op. cit.

53. McCaffree et al. 1976, op. cit.

54. McCaffree et al. 1979, op. cit.

55. Flagle et al., op. cit.

56. McCaffree et al. 1976, op. cit.

57. Foohey, B.J. Long Term Care Regulation: An Examination of the Inspection Process, unpublished Master's Thesis, Yale University, Department of Epidemiology and Public Health, 1981.

58. Fries, B.E. and Cooney, L.M. "A Framework for Long Term Care Patient Classification: Implications for Reimbursement" in press.

Section 5

59. McCaffree et al. 1976, op. cit.

60. McCaffree et al. 1979, op. cit.

61. Flagle et al., op. cit.

62. Skinner and Yett, op. cit.

63. Parker and Boyd, op. cit.

64. Swearingen, op. cit.

65. Willemain, T. "A Comparison of Patient-Centered and Case-Mix Reimbursements for Nursing Home Care" Health Services Research 15:365-377 (Spring) 1980.

66. Kane, R.A. "Multidimensional Measures" Chapt. 5 in Kane R.A. and Kane, R.L. op. cit., pp. 209-241.

APPENDIX A

CONNECTICUT PSRO II PATIENT ASSESSMENT CODING MANUEL

1/7/80

CATEGORY	DESCRIPTORS	DEFINITION	CODING INSTRUCTIONS
1. PATIENT NAME		The name of the patient being reviewed.	PRINT the last name, first name and middle initial in the space provided.
2. SEX	1. Male 2. female	The sex of the patient being reviewed.	Write "1" for male, "2" for female in the box.
3. DOB		The month, day and year the patient was born.	Right justify with zeros to 2 digits for month, 2 for day, 2 for year. Example: May 6, 1903 = 050603
4. SOCIAL SECURITY NUMPER		The Social Security number (SSN) of the patient being reviewed.	Write the SSN of the patient. Dashes have already been inserted at the appropriate places.
5. RES ZIP		FOR ADMISSION AND PRIV TO PENDING REVIEWS ONLY: The zip code of the patient's usual residence before acute hospitalization or admission to this LTC facility.	For first admissions to this LTC facility only. Leave blank for readmits & CSR. Write the 5-digit zip code according to the attached Zip Code Sheet for Conn. Write in 5 **nines** for out-of-state admissions.
6. T18		The patient's Title 18 (Medicare) number	Write the patient's T18 number. Dashes have already been inserted at the appropriate places.
7. FACILITY		The LTC Facility into which the patient is being admitted, or is currently residing.	Write the 3-digit Facility Code.

Revised 1/9/80

CATEGORY	DESCRIPTORS	DEFINITION	CODING INSTRUCTIONS
8. T-19		The patient's Title 19 (Medicaid) number.	Write the patient's T19 number. Dashes have already been inserted at the appropriate places.
9. PSRO REVIEWER		The unique number assigned to each coordinator for identification purposes.	Write your own identification code. Right justify with zero.
10. RACE	1. White 2. Black 3. American Indian or Alaskan native 4. Asian or Pacific Islander 5. Not Determined	The race of the patient being reviewed.	Write the number which corresponds to the patient's race.
11. ETHNICITY	1. Hispanic origin 2. Not of Hispanic origin	The patient's ethnic origin.	Write the number which corresponds to the patient's ethnicity.
12. MAPITAL STATUS	1. Single 2. Married 3. Widowed 4. Divorced 5. Separated 6. Not Determined	The patient's current marital status. "Single" includes those whose marriages were annulled. "Separated" means living apart due to marital discord; includes but is not limited to legal separation.	Write the number which corresponds to the patient's current marital status.

CATEGORY	DESCRIPTORS	DEFINITION	CODING INSTRUCTIONS
13. PRIOR LIVING ARRANGEMENT	1. Alone 2. w/spouse 3. w/relative 4. w/others 5. Institution 6. Not Determined	FOR ADMISSION AND PRIV. TO PENDING REVIEWS ONLY: FOR ADMISSION REVIEWS: The usual living arrangement of the patient for the six months prior to their most recent admission. FOR PRIV. TO PENDING REVIEWS: The usual living arrangement of the patient prior to original date of admission to this LTC facility. "Others" refers to non-relatives in non-institutional setting. "Institution" refers to any facility (including health care.)	Write the number which corresponds to the patients prior living arrangement.
14. RESPONSIBLE PARTY	1. Spouse 2. Child 3. Sib 4. Other	The person or agency which claims responsibility for the patient. Includes but is not limited to legal responsibility. The relationship of the responsible party to the patient.	PRINT the last name, first name, middle initial and complete address of the responsible party on the lines provided. Write the number which corresponds to the relationship of the responsible party to the patient.
15. ATT. PHYSICIAN		The name of the physician who is primarily responsible for the patient's care.	PRINT the last name, first name and middle initial in the space provided.
16. NO. OF VISITS		FOR CSR T18, CSR T19 AND MEDICAL STATUS REVIEWS ONLY: The total number of visits by the attending physician in the last six months. Of that total, the number that were for a specific cause and the number that were routine.	Write the total number of visits in the first two blocks; the number for cause in the second two blocks and the number for routine purposes in the last two blocks. Right justify with zeros in each set of blocks.

CATEGORY	DESCRIPTORS	DEFINITION	CODING INSTRUCTIONS
7. TYPE/DATE OF ADM	1. First Admission 2. Re-admission	FOR ALL REVIEWS EXCEPT PRIV. TO PENDING: Type refers to the type of the current or most recent admission. Date is the date of that admiss. FOR PRIV. TO PENDING REVIEWS: Type refers to the type of original admission and will always be a 1. First Admission. Date refers to the date of that original admission. The admission status of the patient for this LTC fac. only.	Write the number which corresponds to the patient's admission status. Write the date of the patient's most recent admission. Right justify with zeros.
17a. TYPE/DATE OF REV.	1. Admission 2. Priv. to Pend 3. CSR 18 4. CSR 19 5. Med Stat Change	The reason the review is being done, and the date.	Write the number which corresponds to the reason this review is being done Write the date on which this review is being done Right justify.
18. HOSP LOS		FOR ADM. AND MED STAT T18 REVIEWS ONLY: The actual number of days the patient was in a qualified hospital (acute psychiatric, etc.) if hospitalization occurred during past 14 days.	Write the number of days the patient was in hospital. Right justify.
19. HOSP/PAC DAYS CERT		FOR ADM. REVIEWS ONLY: The number of days assigned at hosp for which patient was placed at particular level of care in LTC fac.	Write the number of PAC days. Right justify.
20. TRANSFER FROM	1.Home 2.Gen Hosp 3.Rehab Hosp 4.Psych Hosp 5.In Area SNF 6.In Area Non-SNF 7.Out of Area LTC 8.Out of State LTC	FOR ADM. AND PRIV. TO PENDING REVIEWS ONLY: FOR ADMISSION REVIEWS: The immediate location of the patient prior to this admission. FOR PRIV. TO PENDING REVIEWS: Immediate location of patient prior to original admission.	Write the number which corresponds to the patients location before admission. For 2-8, write name of fac trans from.

CATEGORY	DESCRIPTORS	DEFINITION	CODING INSTRUCTIONS
21. LOC/DAYS CERT	1. SNF 2. AND 3. ICFAND 4. ICF	The level of care which the Review Coordinator assigns at this review. The number of days assigned at that level of care. SNF - Person requires skilled LOC by federal definition. ICFAND - Does not meet Federal guidelines for skilled care. Contains wide spectrum of patients with needs of varying intensity. AND - Person confined to SNF for life safety. Code reasons - cannot vacate facility due to mental and/or ambulatory status. ICF - Medically stable, ambulatory, and alert.	Write the number which corresponds to the level of care you have assigned at this review. Write the number of days you have assigned. Right justify with zeros.
22. PAYMENT SOURCE	1. T-18 - Medicare 2. T-19 - Medicaid 3. P - Private 4. Priv. to Pending	1. Stay reimbursed by Medicare. 2. Stay reimbursed by Medicaid. 3. Stay paid by private funds.	Code the one number which corresponds to the patient's pay source at this review.
23. LOC NEXT REVIEW TYPE/DATE	1. CSR T-18 2. CSR T-19	The type of LOC review which will be performed next. The date the Review Coordinator sets for that review.	Write the number that corresponds to the type of next LOC review. Write the date set for that review. Right justify wit zeros.

CATEGORY	DESCRIPTORS	DEFINITION	CODING INSTRUCTIONS
24. REASON FOR PLACEMENT	Prolonged		Code the one number which corresponds to the reason the patient was most recently admitted to this facility.
	1. Cognitive Disability	Cognitive Disability - inability to function independently because of organic mental disease (including mental retardation, senility) or psychiatric problems.	
	2. Physical Disability	Physical Disability - inability to function due to physical limitations.	
	3. Severity of Medical Illness	Severity of Medical Illness - an unstable medical condition that requires intensive medical and nursing care on a daily basis to maintain present health status of patient.	
	4. Terminal Care	Terminal Care - patient's condition is terminal; requires an aggregate of skilled and/or nonskilled services to maintain comfort throughout a prorgessively deteriorating condition.	
	Temporary for Restorative Care following 5. Fractured Hip 6. CVA 7. Amputation 8. Other Fracture 9. Surgery 10. Other	Restorative Care - patient is admitted to the facility for care of one of the following problems (5 thru 10) with a goal of achieving a greater functional ability.	

CATEGORY	DESCRIPTORS	DEFINITION	CODING INSTRUCTIONS
24. REASON FOR PLACEMENT (Cont.)	Temporary for Convalescent Care		
	11. Recuperation	Recuperation - patient is admitted to the facility to recover from a medical or surgical illness. There are no skilled services required.	
	12. Social Problems	Social Problems - patient is admitted to the facility on a temporary basis because of extenuating social circumstances. This is the primary reason for placement and none of the reasons (1 thru 11) are present.	
	13. Other	Other - describe circumstances in a narrative section.	
25. REHAB POTENTIAL	1. Optimal 2. Moderate 3. Slight 4. None	Describes probability of patient achieving greater functional ability. Optimal - most favorable Moderate - fair Slight - minimal None -	Write the number which corresponds to the patient's rehab potential at this review.

CATEGORY	DESCRIPTORS	DEFINITION	CODING INSTRUCTIONS
26. DIAGNOSES	1. Primary 2. Secondary 3. Secondary 4. Secondary 5. Secondary	Primary diagnosis - diagnosis patient is admitted with and primarily being treated for. Secondary diagnoses - new or old problems, at present - remains stable.	Write in the primary diagnosis first (the reason for the patient's most recent admission) and any other new or old problems and diagnoses. Do not code.
27. DECUBITUS	1. None 2. Superficial 3. Moderate 4. Extensive	1. None - no decubiti at this time. 2. Superficial - only cutaneous involvement. 3. Moderate - subcutaneous involvement (1/2" to 2 inch width) (1/2" to 1 inch depth) 4. Extensive - width and depth beyond above measurements, subcut fascial planes; muscle involvement, boney involvement: multiple subcut lesions, ulcer source of systemic involvement	Code the number which corresponds to the patients decubital problem at this review.
28. MENTAL STATUS	1. Clear 2. Minimally confused 3. Moderately confused 4. Severe confusion 5. Comatose 6. Not Determined	Describes mental status of patient. 1. Clear - alert and oriented as to time and place 2. Minimal - occasional memory lapses; capable of independent activities; requires supervision with ADL's. 3. Moderate - confused some of the time; requires assistance with ADL's.	Code the number which corresponds to the patient's mental status at this review.

CATEGORY	DESCRIPTORS	DEFINITION	CODING INSTRUCTIONS
MENTAL STATUS CONTINUED		4. Severe - completely disoriented as to time, place and person; unable to carry out ADL's; total assistance due to confusion. 5. Comatose - unable to respond to any stimuli.	
29. SENSORY VISION/ HEARING	1. No loss w/wo aid 2. Impaired 3. Total loss 4. Not determined	1. Hears or sees adequately in most situations with or without use of hearing aid or glasses. 2. Some functional sacrifice i.e., cannot read newspapers, medication labels, with or without glasses. Cannot hear without special effort of raised volume; slow, loud diction. 3. Virtually or legally blind or deaf, can, at best, only tell light from dark. Verbal communication totally unreliable.	Code the one number which corresponds to patient's ability to express himself and code the one number which corresponds to the patient's ability to comprehend others. (2 codes are required).
30. COMMUNICATION EXPRESSIVE/ RECEPTIVE	1. Oral communication 2. limited oral communication 3. Technical/ primative communication 4. Language barrier 5. Cannot communicate	Expressive - 1. Speaks and is usually understood. 2. Speaks, but is understood with difficulty. 3. Uses gestures, sign language, writing to communicate. 4. Cannot communicate effectively in English. 5. Cannot convey needs	Code the one number which corresponds to patient's ability to express himself, and code the one number which corresponds to the patient's ability to comprehend others. (2 codes are required)

CATEGORY	DESCRIPTORS	DEFINITION	CODING INSTRUCTIONS
COMMUNICATION CONTINUED	6. Not determined	Receptive - 1. Usually understands oral communication. 2. Has limited comprehension of oral communication 3. Uses lip reading; written material, gestures, sumbols. 4. Cannot adequately understand English. 5. Unable to understand commands	
31. BEHAVIOR PROBLEMS	None Agitated Belligerent Wandersome Noisy Not Determined	Agitated - restless Belligerent - hostile, quarrelsome resistive, combative Wandersome - tendency to stray without purpose; becomes lost, unable to avoid simple dangers. Noisy - Screams; cries	Make a check mark (✓) in every box which describes the patient's behavior.
32. MOOD DISTUPBANCE	None Apathetic/passive Anxious Depressed Not Determined	None - Apathetic/passive - indifferent, lacks interest, submissive Depressed - low in spirits, lacks hope; dejected Anxious - fearful, worried, uneasy	Make a check mark (✓) in every box which describes the patient's moods.

CATEGORY	DESCRIPTORS	DEFINITION	CODING INSTRUCTIONS
33. RESTRAINTS	1. None 2. Physical 3. Chemical 4. Combined 5. Not Determined	Restraint refers to that which hinders or restricts patient from injuring self 1. None 2. Physical - use of posey vest or waist restraint; wrist restraints; geri-chair 3. Chemical - psychoactive drugs used to produce sedated state to restrain patient. 4. Combined - use of drugs and physical restraints	Write the number which corresponds to the patient's status regarding restraints.
34. SOCIABILITY WITH STAFF/ RESIDENTS	1. Sociable 2. Minimally soc. 3. solitary 4. Not Determined	Adjectives - friendliness; congeniality 1. Sociable - gets along well with all in contact with. 2. Minimally sociable - reluctant to mingle, retiring 3. Solitary - decided preference to stay alone	Write the number which corresponds to the patient's sociability.
35. SOCIAL CONTACTS	Spouse Family Clergy Friends Mail/phone	1. Daily 2. Weekly 3. Monthly 4. Occasionally 5. Never 6. Not Determined The type and frequency of the patient's social contacts	Write the one number which describes the frequency of contact the patient has in each of the five categories. (5 codes are required).
36. PLANNED ACTIVITIES	1. Attends most 2. Attends few 3. Never attends 4. Not offered 5. Not Determined	Describes patient's participation in or attendance at Social, Religious, and/or Recreation programs	Write the number which corresponds to the patient's planned activity level.

CATEGORY	DESCRIPTORS	DEFINITION	CODING INSTRUCTIONS
37. AMBULATION	1. Independence with or without assistive device 2. Walks with supervision 3. Walks with continuous physical support 4. Bed/chair - total assistance 5. Bedrest	Describes persons mobility status or facility of movement 1. Independent - can walk independently with or without assistive device 2. Walks with supervision - patient requires guiding or cuing to walk safely but usually doesn't require phy. support 3. Walks with continuous physical support. Patient requires physical support from 1 or more people to walk. 4. Bed/chair - patient cannot walk even with assistance and is limited to bed or chair (incl. wheelchair) 5. Bedrest	Write the number which corresponds to the patient's ambulation status.
38. TRANSFERS	1. Independent 2. Minimal assist of one person 3. Moderate assist of one person 4. Maximal assistance 2 or more persons 5. Bedrest	Describes persons ability to move from one position to another - (i.e., sitting, standing; lying) e.g. - bed to standing standing to chair chair to bed	Write the number which corresponds to the patient's ability to transfer

CATEGORY	DESCRIPTORS	DEFINITION	CODING INSTRUCTIONS
39. WHEELCHAIR USE	1. Independent 2. Assistance 3. Not Determined	Independent - no assistance Assistance - assistance to guide w/c from room to room Not applicable - does not use wheelchair	Write the number which corresponds to the patient's w/c status.
40. CONTINENCE BLADDER BOWEL	1. Continent 2. Occasionally incontinent 3. Frequently incontinent 4. Total incontinence 5. Indwelling cath 6. Straight cath 7. Not Determined	1. Continent - full control or rarely incontinent 2. Occasionally incontinent - incontinent approx. 2-3 times wk or nighttime only 3. Frequently incontinent - incontinent daytime; inc 1 x or more/day. 4. Total incontinence - total lack of control 5. Indwelling catheter - patient currently using indwelling cath regularly 6. Straight catheter - patient receiving intermittent straight catheterization.	Write the one number which corresponds to the patient's bladder status; and write the one number which corresponds to the patient's bowel status (2 codes required).
41. ADL's Bathing Dressing Feeding Personal Hyg. Toileting	1. Independent 2. Supervised 3. Supported 4. Total care 5. Not Determined	Independent - requires no assistance. Supervised - requires supervision of facility personnel to perform activity. Supported - Requires physical assistance of staff person to perform activity. Total Care - Totally reliant on staff to perform activity.	Write the one number which corresponds to the patient's ability to perform each ADL. (5 codes required.)

CATEGORY	DESCRIPTORS	DEFINITION	CODING INSTRUCTIONS
42. DIRECT SERVICES Physical Therapy	Range of Motion Transfer Train. Ambulation Train. Muscle Strength. Splint/Ass't Dev Whirlpool Debridement Other None Not Determined	1. Daily 2. 2-3/week 3. Weekly 4. > Weekly Describes the selected services given directly to a patient by a Registered Physical Therapist -- Describes frequency of treatments.	Write the one number which describes the frequency of each service the patient receives. Leave other boxes blank.
Speech Therapy		Describes the selected services given directly to a patient by a Registered Speech Therapist.	Write the one number which describes the frequency of speech Therapy. Leave blank if not receiving speech therapy.
43. SPECIAL SERVICES	Nursing Rehab Bowel Training Bladder Training Diabetic Instr. Ostomy Care Reality Orientation Therapeutic Diet Patient/Fam. Educ. Other Health Prof. Mental Health Social Services Sheltered Employ. Other None Not Determined	Nursing Rehab - direct or supervised care of patient in achieving goals of rehab through demonstration or practice sessions, teaching programs, e.g. PT following ADL train. Bladder/Bowel Train - Program ordered by physician , conducted by nursing staff. Written plan for fluid intake, toileting, ambulation, etc.; results recorded q.d. Diabetic Instr. - Educational program conducted by nursing staff to orient patient to needs of diabetic: diet (food exchange), foot care, adm. of meds (side effects) urine testing	Make a check mark (✓) for every service the patient is receiving. If "other," write in name of service.

CATEGORY	DESCRIPTORS	DEFINITION	CODING INSTRUCTIONS
		Ostomy Care (bladder & bowel) - Patient requires assist or total care of ostomy including special skin care, measurement of drainage, changing of external apparatus, irrigations Reality Orientation - Planned program. Repetitive attempts to maintain patient's current level of orientation to time, place and person. Therapeutic Diet- Any therapeutic diet e.g. diabetic, low Na, low K, high protein. Patient/Family Education - Program designed by nursing staff using a multidisciplinary approach. Intent is usually for self care or care of patient by family in home setting. Other Health Professional - Care or consult by dentist, podiatrist, dietician, etc. Mental Health - Care or consult by psychiatric social worker, psychologist, psychiatrist or physician rendering counseling services.	

CATEGORY	DESCRIPTORS	DEFINITION	CODING INSTRUCTIONS
		Social Services - Evaluation and follow-up by social worker or designee of psychosocial problems and/or needs. Sheltered Employment - Attends workshop out of facility for specified number of hours per week.	
44. SPECIAL TREATMENTS	Special Skin Care Decubitus Care IV fluids Oxygen Therapy Tracheostomy Care Special Ostomy Care Intake/Output Frequent Vital Signs Sterile Dressings Suctioning Drug Regulation Irrigations/Special Cath Care Tube Feedings Wound Care Clysis None Not Determined	Special Skin Care - Care to skin other than routine application of lotion for preventive measures. e.g. medicated creams, lotions, ointments; prophylactic pressure dressings. Decubitus Care - Described by nurse and ordered by physician. Document treatment given, results and improvement, if any. Intravenous Fluids - Adm. of IV fluids as ordered by attending physician. Oxygen Therapy - Ordered as specified; liter flow; adm. continuously or intermittently. Tracheostomy Care - New or old trach. Includes cleansing of tube and inner cannula, cleansing of skin around site,	Make a check mark (✓) for every special treatment the patient is receiving.

CATEGORY	DESCRIPTORS	DEFINITION	CODING INSTRUCTIONS
		suctioning, patient education. Special Ostomy Care - Other than routine maintenance such as changing of bag. Includes special skin care, application of dressings and special apparatus, observation of wound; stoma; output, etc. Intake/Output - Careful monitoring of all po intake, plus clysis on IV's and all output noting frequency. Done on q shift basis. Also, weekly or daily weights. Frequent Vital Signs - Blood pressure, temp., pulse and respirations taken and recorded minimally on a q shift basis. Sterile Dressings - Application of sterile dressings using aseptic technique. Suctioning - Suctioning of a patient; nasal, nasopharyngeal, endotracheal. Drug Regulation - Adm. of medications (p.o.or I.M.) by a licensed clinician. Observation by skilled nursing personnel if required to adequately evaluate patient's progress and observe for drug effectiveness.	

CATEGORY	DESCRIPTORS	DEFINITION	CODING INSTRUCTIONS
		Irrigations/Special Cath Care - Irrigation with other than saline solution on a q shift basis. Catheter care other than routine cleansing. Tube Feedings - Adm. of feeding via nasogastric or gastrostomy tube. Wound Care - Other than application of DSD e.g. as follows: special cleansing - debridement observation of healing process application of medicated ointments or solutions irrigation of wound Clysis - Hypodermoclysis.	
45. MEDICATIONS	(as listed on form)	Refers to a medication the patient is receiving at this review. Physician Orders are not sufficient to establish that drug was actually administered. Check medications sheets and/or medical record.	Code the 2-digit number which corresponds to the medication the patient is receiving under "M". Code the number which refers to the frequency with which the drug is given under "F". Code the route by which the medication is given under "R". (3 codes are required for each medication listed.)

CATEGORY	DESCRIPTORS	DEFINITION	CODING INSTRUCTIONS
46. PATIENT STATUS	1. Improved 2. Stationary 3. Unstable 4. Deteriorating	Improved - patient's general health has gotten better since last review. Stationary - no change in health status since last review. Unstable - fluctuation in patient's status. Deteriorating - Decline in patient's health status since last review.	Code the one number which corresponds to the patient's general health status at this review.
47. QUALITY ASSURANCE PROBLEM	None Medical Care Nursing Care Other	A problem or problems exist in the areas of medical, nursing and/or other (administrative, plant operation, etc.) which the Review Coordinator determines need immediate attention.	Write a check mark (✓) in each box which corresponds to a quality assurance problem. Explain problem in narrative section.

APPENDIX B

Available as:

Stratton, S.D. Statistical Analysis of Connecticut Nursing Homes unpublished Masters Thesis, Yale University, Department of Epidemiology and Public Health, 1982.